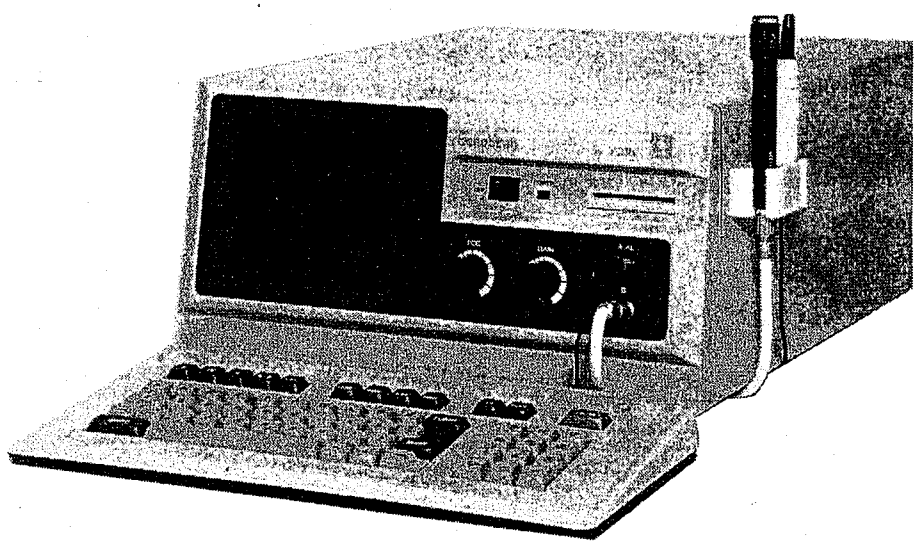
NIDEK ECHOSCAN

Model US-3300

Operator's Manual



NIDEK CO., LTD.

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Introduction

1.1 Scope of Manual

This manual contains information to understand the NIDEK EchoScan Model US-3300. This manual provides a general description of the instrument, cautions, specifications, accessories, procedures for operation and maintenance. This instrument has undergone extensive testing, and with proper handling, is a useful and reliable clinical instrument.

The use of this instrument is limited to the diagnosis of eye disorders by qualified physicians only.

The correct use of the Model US-3300 requires through understanding of the operating procedures in this manual before using this instrument.

1.2 Outline of instrument

The NIDEK EchoScan Model US-3300 is an ultrasonic diagnostic instrument which applys the ultrasonic pulse reflection method, consisting of main unit, keyboard, probes and foot switch.

The ultrasonic pulse is transmitted by a transducer, reflected from each boundary face of intraocular tissue and received by the transducer.

US-3300 displays and measures conditions of intraocular tissue by the intensity of received echo and the time required for this process.

In B-mode, a tomography image of the eyeball is obtained by scanning with changing the angle of transducer mechanically. The intensity of the received echo is transformed into the brightness, and then displayed 2-dimentionally according to the place where the echo is produced. This 2-dimentionally display is utilized for diagnosing retinal detachment, vitreous hemorrhage, intraocular tumor and intraocular foreign body in the ophthalmic clinic.

By using the A-mode probe (the probe for axial length measurement : optional accessory), it is possible to display the A-mode image and measure the axial length. The axial length is measured as one of the parameters in order to determine the refractive power of IOL, when implanting IOL in the cataract surgery. In addition, this instrument has a function to calcurate the refractive power of IOL to be implanted by inputting other parameters.

Principle

When voltage pulse is applied to a transducer housed in a probe, the transducer is vibrated and the pulsed ultrasonic waves are emitted. The ultrasonic waves have the following properties similar to light underwater or mediums like water.

①They travel straight underwater.

②They are reflected from and refracted on the boundary faces of the mediums where the acoustic impedances differ.

(Acoustic impedance = Density of medium × Velocity under medium)

By touching the probe to the eyeball, the ultrasonic pulse travels inside the eye. And a part of the pulse is reflected from each boundary face between the probe tip and the cornea, cornea and anterior chamber, anterior chamber and lens, lens and vitreous, and vitreous and retina. Its echo is received at the same probe that the ultrasonic pulse is transmitted, and then displayed as the electronic acoustic signal on the display.

In B-mode, the echo intensity is displayed as the brightness and a tomography image of eyeball is obtained by scanning with changing the angle of the transducer mechanically.

In A-mode, the echo intensity is displayed as the height of the waveform. And it is possible to calculate the each length of the intraocular tissue (axial length, anterior chamber depth, lens thickness and vitreous length) by converting the difference of time which takes to receive each echo into the distances. But, when the direction of the ultrasonic waves is not perpendicular to each boundary face, the echo is rather weak or does not return to the probe. Therefore, the contacting position of the probe on the cornea is very important to achieve a correct measurement.

Features

1 DSC (Digital Scan Converter) allows the operator to obtain the stable image without flickering.

2 As any image can be memorized (Freezing display), operator can read it without giving any unnecessary burden to the patient.

3 In the CV-mode, A-mode waves of cross vector on B-mode can be seen together with B-mode image simultaneously.

4 It is possible to display and memorize up to 4 images on one screen for comparable observation. And a part of image can be expanded.

5 By changing the observable range (60mm or 40mm), the proper part can be observed.

6 The instrument has 2 system calipers which enable measurement of affected part and other wider applications.

7 By using the A-mode probe (the solid probe for axial length measurement : optional accessory), it is possible to measure the each length of the intraocular tissue (axial length, anterior chamber depth, lens thickness and vitreous length) and make a diagnosis by A-mode waveform.

8 US-3300 provides the famous IOL formulas (BINKHORST, HOLLADAY, SANDERS-RETZLAFF-KRAFF-II) ; therefore it is possible to calculate the refracted power of IOL to be implanted without complicated calculations.

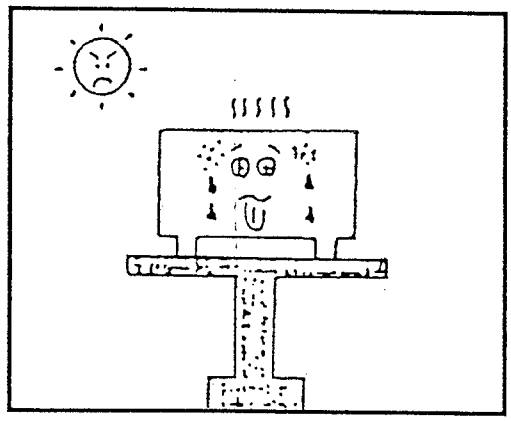
9 Possible to memory a maximum of 8 IOL data (Style name, ACD value, SF value, A-constant).

10 File card (optional accessory) can record measured value, B-mode image and IOL data.

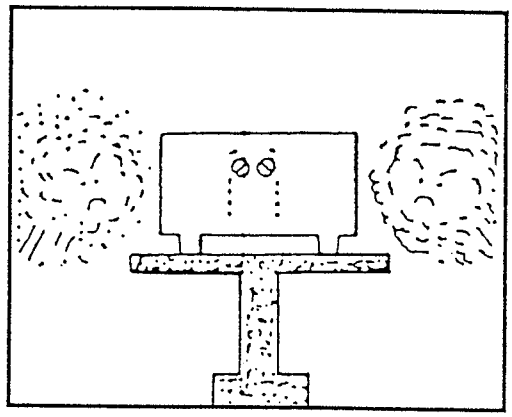
Cautions

4.1 Place of installation

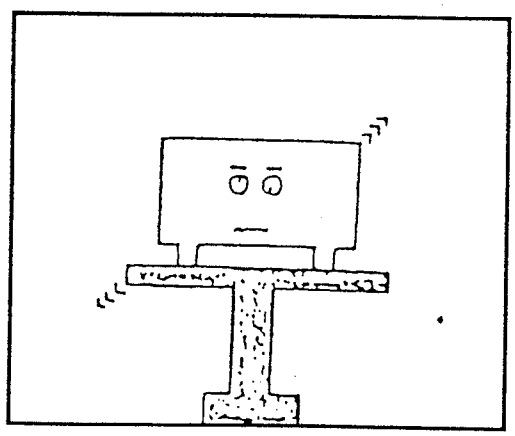
1) Keep the instrument away from dusty locations, direct sunlight, high temperature, or high humidity.



2) Keep the instrument away from the chemicals or gases.



3) Place the instrument in stable place vibration and strong shock are not made. (Same care shall be taken during transportation.)



4.2 Cautions on handling

1) Be sure to connect or disconnect the B-mode probe in either the POWER switch OFF or freezing condition. If connecting or disconnecting the probe in the scanning condition, it may be damaged.

2) Be sure to hold the probe plug, when connecting or disconnecting the probe. If the holding the only probe cable, it may be broken. And pay attention not to shock the probe.

3) Sterilize the probe tip with the medical fluid. Never sterilize it with an autoclave.

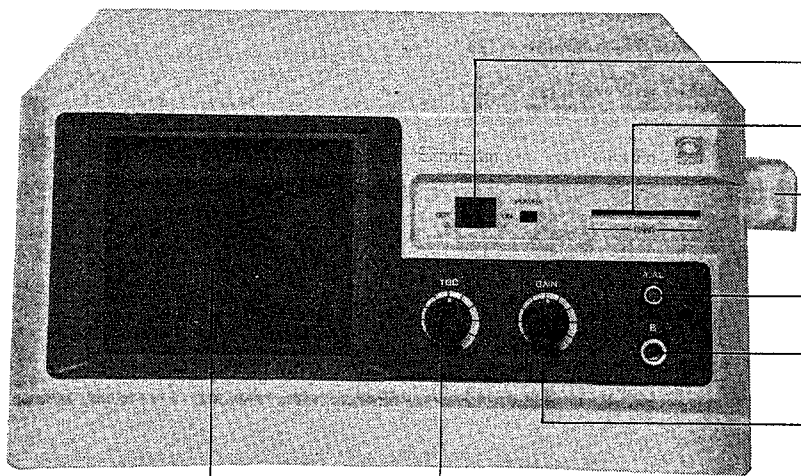
4) Never place anything behind the rear panel, and never block the fan.

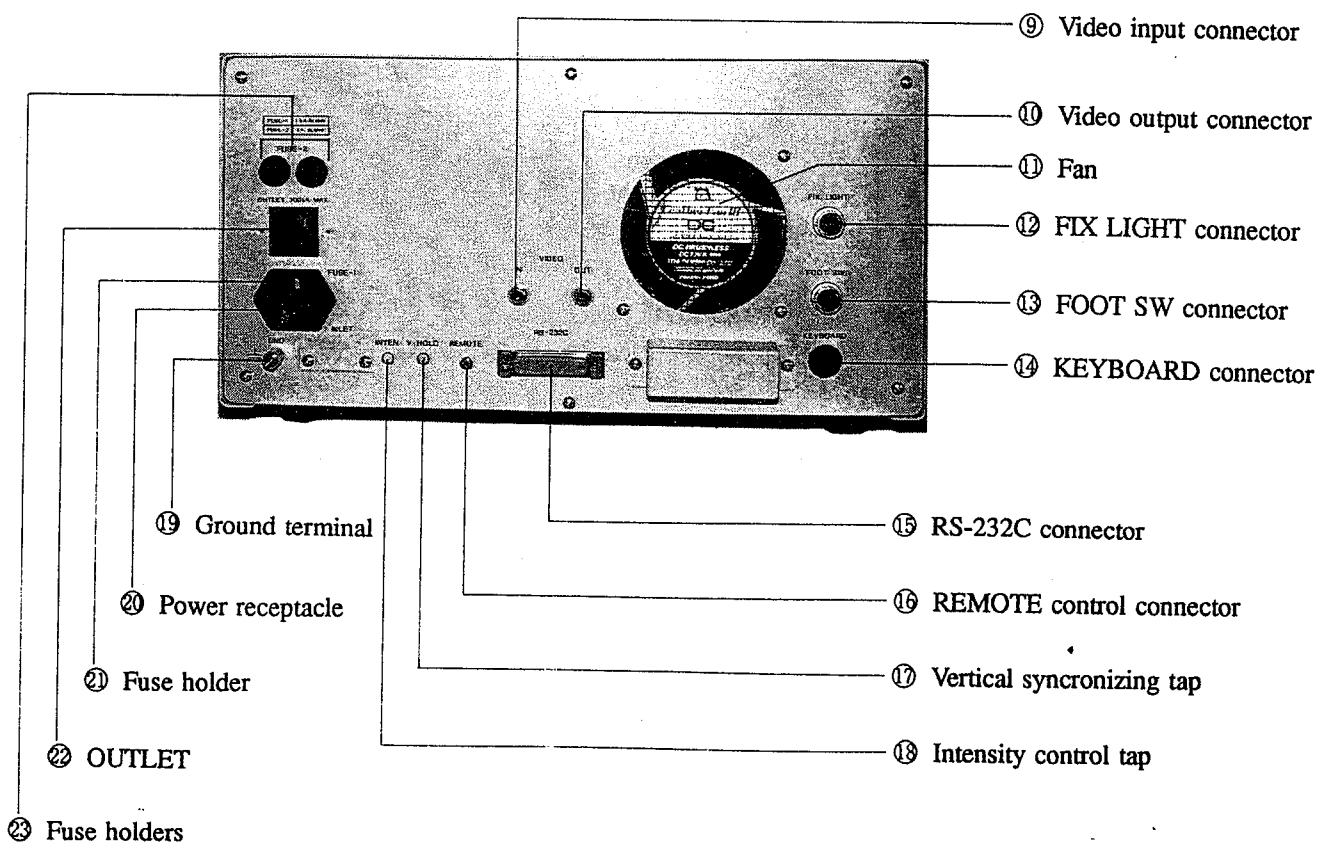
5) Never pull the keyboard, probe and foot switch cables by force.

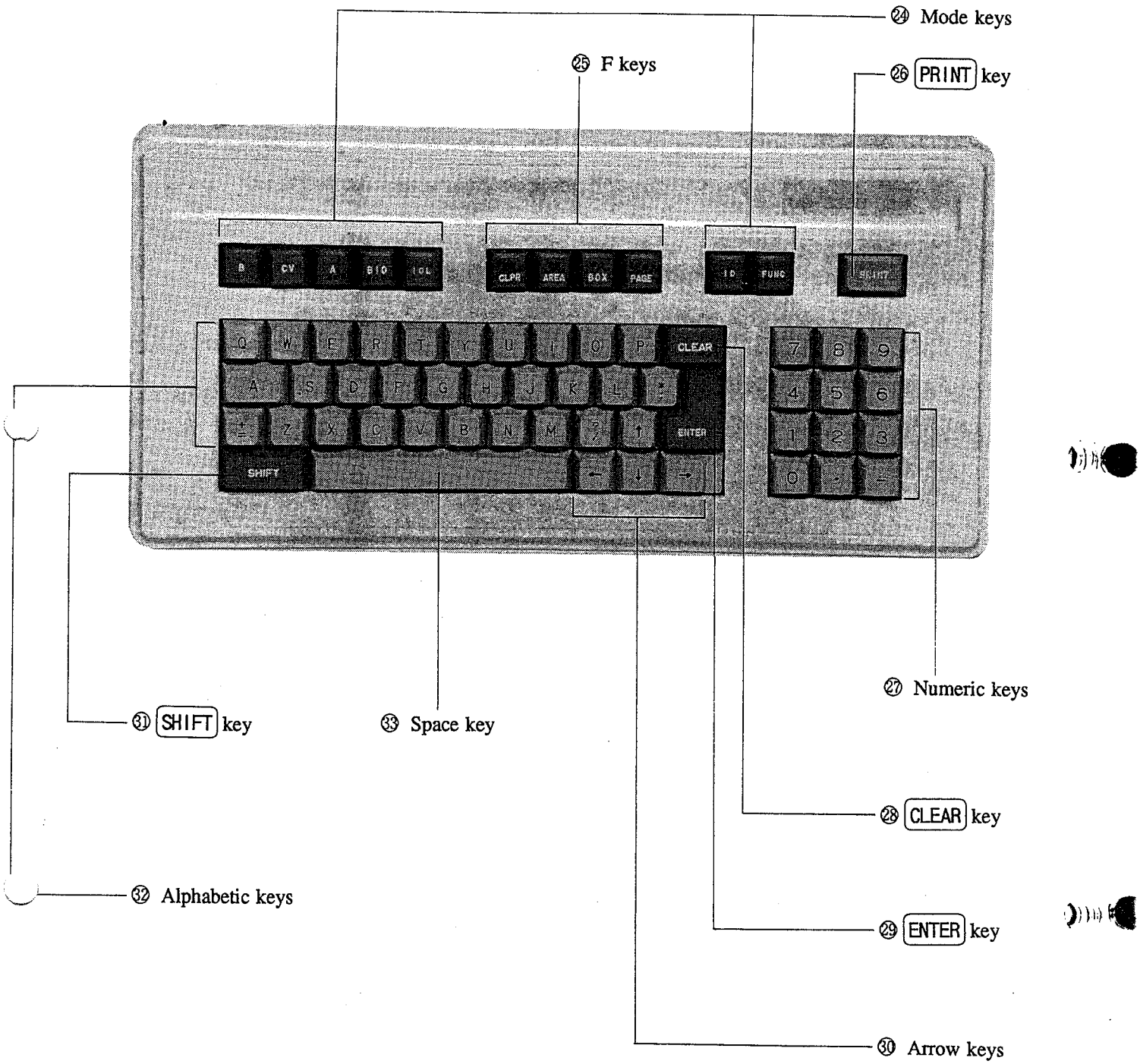
6) Disconnect the power cord from the outlet when the instrument is not in use for a long time.

7) When you have trouble with the instrument, never touch the inner part and contact your purchased distributor.

Controls


① Power switch
② CARD slot
③ Probe holder
⑤ A-mode probe connector
④ B-mode probe connector
⑥ GAIN control
⑦ Time Gain Compensation control
⑧ Monitor


⑨ Video input connector
⑩ Video output connector
⑪ Fan
⑫ FIX LIGHT connector
⑬ FOOT SW connector
⑭ KEYBOARD connector
⑲ Ground terminal
⑮ RS-232C connector
⑳ Power receptacle
⑯ REMOTE control connector
㉑ Fuse holder
⑰ Vertical syncronizing tap
㉒ OUTLET
⑱ Intensity control tap
㉓ Fuse holders


㉔ Mode keys
㉕ F keys
㉖ PRINT key
㉗ Numeric keys
㉘ CLEAR key
㉙ ENTER key
㉚ Arrow keys
㉛ SHIFT key
㉜ Alphabetic keys
㉝ Space key
CLEAR
ENTER
SHIFT

① Power switch

In this switch ON, the pilot lamp is lit on.

② CARD slot 〔CARD〕

File card (optional accessory) for data store etc. put into this slot.

③ Probe holder

The probe holder is designed to hold the A-mode and B-mode probes in a safe position.

④ B-mode probe connector

The B-mode probe cable is connected to the B-mode probe connector.

⑤ A-mode probe connector

The A-mode probe (optional accessory) cable is connected to A-mode probe connector.

⑥ GAIN control 〔GAIN〕

The GAIN control adjusts total gain.

⑦ Time Gain Compensation control 〔TGC〕

The TGC control adjusts near-field gain.

⑧ Monitor

The monitor displays the data input, B-mode images, A-mode waveforms, and IOL power calculations.

⑨ Video input connector 〔IN〕

This connector is used to play back the recorded images on the monitor with the video cassette recorder.

⑩ Video output connector 〔OUT〕

This connector is used to record or print out the images with the video cassette recorder or video printer (optional accessory).

And it is possible to display the B-mode images on the bigger display by connecting to the external monitor.

⑪ Fan

The fan provides electronic cooling of the instrument.

⑫ FIX (Fixation) LIGHT connector 〔FIX. LIGHT〕

The FIX LIGHT connector receives a cable with a four pin connector, leading from the probe stand (optional accessory), to provide power to the fixation lamp.

⑬ FOOT SW connector 〔FOOT SW.〕

The FOOT SW (Switch) cable plugs into the foot switch connector.

⑭ KEYBOARD connector 〔KEYBOARD〕

The keyboard cable plugs into the keyboard connector.

⑮ RS-232C connector 〔RS-232C〕

The RS-232C connector is an input connector receiving corneal curvature data measured by either NIDEK Autokeratometer KM-800, or Autoref/keratometer ARK-2000.

⑯ REMOTE control connector 〔REMOTE〕

The remote control cable of the video printer (optional accessory) is connected to this connector.

⑰ Vertical syncronizing tap 〔V. HOLD〕

When the image on the display runs up and down, adjust it with the small screwdriver.

⑱ Intensity control tap 〔INTEN〕

The INTEN control is rotated to adjust the brightness of the monitor.

⑲ Ground terminal 〔GND〕

The Ground terminal provides a place to connect a ground cable when the instrument is in use.

⑳ Power receptacle 〔INLET〕

The Power receptacle receives the female plug of the power cord, which provides the main power source to the instrument.

㉑ Fuse holder 〔FUSE-1〕

Slow-blow fuse (1.6A) is built in this holder, and this holder serves as a voltage selector.

㉒ OUTLET 〔OUTLET 300VA MAX.〕

The power cord of the external unit is connected to this OUTLET. And it is also possible to change over the power switch of the external unit by the power switch ① on the front panel.

* As to the instrument for AC220/240V, this OUTLET is not provided.

㉓ Fuse holders 〔FUSE-2〕

Slow-blow fuses (4A) are built in these holders.

㉔ Mode keys 〔B, CV, A, BIO, IOL, ID, FUNC〕

These keys select the modes (B, CV, A, BIO, LIST, IOL, ID-modes and FUNCTION-menu).

- B key

 This key is used to select the B-mode.

- CV key

 This key is used to select the CV-mode.

- A key

 This key is used to select the A-mode.

- BIO key

 This key is used to select the BIO-mode for the axial length measurement and the LIST-mode of the measured values of axial length.

- IOL key

 This key is used to select the IOL-mode to calculate the refractive power of IOL.

- ID key

 This key is used to select the ID-mode to input the patient's data.

- FUNC key

 This key is used to select the FUNCTION-menu (the registration of IOL data, calculation of SF value, change of ultrasonic velocity, change of IOL formula constant, playback of image and setting time and date).

㉕ F keys 〔F1 CLPR, F2 AREA, F3 BOX, F4 PAGE〕

The keys select the operations and functions in the selected mode.

- F1 CLPR key

 This key is used for the caliper function which measures a distance between any 2 points in the B, CV and A-modes. The instruction in other mode is displayed on the upper side of the monitor.

- F2 AREA key

 This key is used for the area function which obtains an area of the B-mode image in the B and CV-modes. The instruction in other mode is displayed on the upper side of the monitor.

- F3 BOX key

 This key is used for the box function which transfers a part of the B-mode image to other screen. The instruction in other mode is displayed on the upper side of the monitor.

- F4 PAGE key

 This key is used for the changing the display in the B or CV-mode to the screen which B-mode images were transferred to with the box function. The instruction in other mode is displayed on the upper side of the monitor.

㉖ [PRINT] key

This key is used to print out the image on the monitor to the video printer (optional accessory).

㉗ Numeric keys

These keys are used to input the numbers and to select the items and diagnostic conditions.

㉘ [CLEAR] key

This key is used to correct the inputted numbers and letters.

As to numbers, the whole item is deleted. As to letters, only one letter at the left side of the cursor is deleted.

㉙ [ENTER] key

This key is used to input numbers and letters and to select items.

㉚ Arrow keys [←, ↑, ↓, →]

These keys are used to move the cross vector line, box and markers, to select the items and to set the time and date.

㉛ [SHIFT] key

By pressing this key with the alphabetic key, a small letter is inputted.

By pressing this key with the [CLEAR] key, all the letters of item inputted are deleted.

㉜ Alphabetic keys

These keys are used to input the patient's data.

㉝ Space key []

Operating procedures

6.1 Preparation

6.1.1 Connections

1) Plug the power cord into the wall outlet.

2) Connect the foot switch cable to the foot switch connector.

3) Connect the keyboard cable to the keyboard connector.

4) Connect the B-mode probe cable to the B-mode probe connector.

CAUTIONS

Be sure to connect the B-mode probe in either the power switch OFF or freezing condition. If connecting it in the scanning condition, it may be damaged.

* Align the connector keyway when connecting the B-mode probe connector.

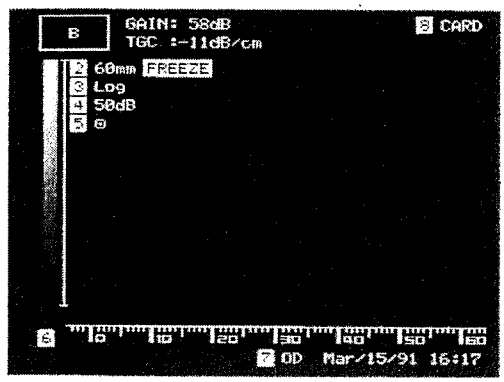
NOTES

1) When using the A-mode probe (optional accessory), connect it to the A-mode probe connector.
2) When preserving the image with the video printer (optional accessory) or video cassette recorder, refer to "6.9 Preservation of image" (p. 6-44) and connect it by the exclusive cables.
3) When using the external monitor etc., connect it to the video output connector. And when inputting or outputting the data with either Autokeratometer KM-800, or Autoref/keratometer ARK-2000, connect it by the interface cable.

6.1.2 POWER ON and change of the mode

Turn the power switch ON.

* "System POWER ON" is displayed, and its indicator is changed to the B-mode screen after a few second.



Change of mode

By pressing the desired mode key, the mode is changed to the desired mode.

- [B] key : B-mode
- [CV] key : CV-mode
- [A] key : A-mode
- [BIO] key : BIO-mode and the LIST-mode
- [IOL] key : IOL-mode
- [ID] key : ID-mode
- [FUNC] key : FUNCTION-menu

6.2 Operation of B-mode

Change into the B-mode. (Refer to "6.1.2 POWER ON and change of the mode" (p. 6-2).)

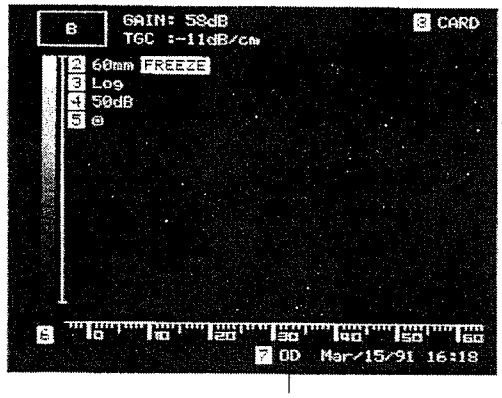
6.2.1 Basic operation

1) By pressing the numeric key [7], select the patient's eye to be diagnosed, right or left.

 * By pressing the numeric key [7], it is possible to change over between "OD" and "OS".

 OD : Oculus Dexter

 OS : Oculus Sinister



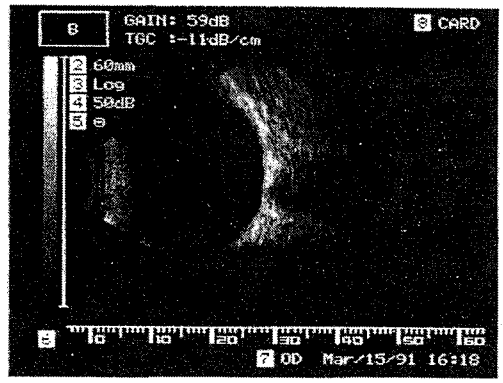
OD/OS

2) Depress the foot switch.

 * The instrument is made in the scanning condition.

3) Touch the B-mode probe to the patient's eye.

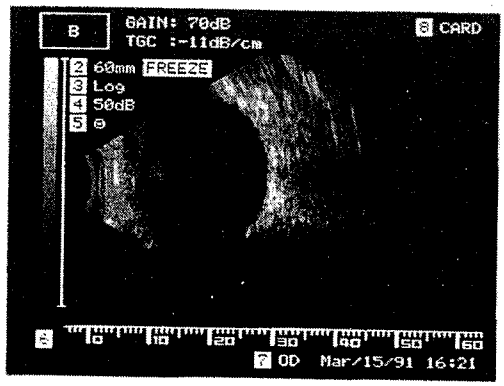
 * B-mode image appears.



4) If necessary, adjust the sensitivity of the image with the GAIN and TGC controls.

5) By depressing the foot switch, the image is frozen and displayed. (Freezing condition)

 * By depressing the foot switch again, the instrument is returned to the scanning condition.



6.2.2 Changeover of observable range

Normally, it is possible to observe the B-mode image up to a depth of 60mm from the probe. But, if necessary, the observable range can be changed over to 40mm.

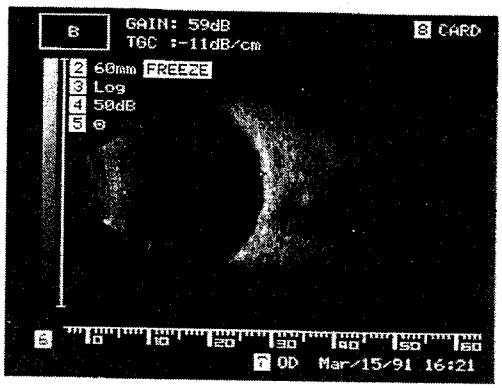
By changing over the range to 40mm, the observable range is narrowed down. But the expanded B-mode image is displayed.

By pressing the numeric key [2], change over the observable range.

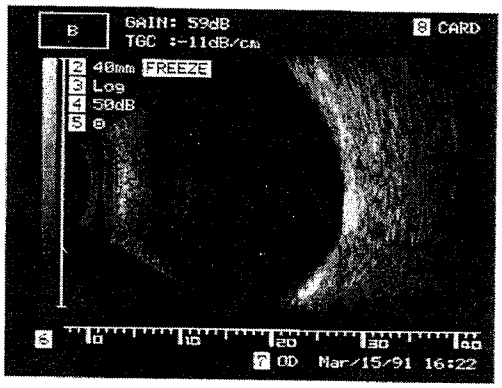
* Whenever pressing the numeric key [2], the obsrevable range is changed over between 40 and 60mm.

NOTE

It is possible to change over the observable range in the freezing condition as well as in the scanning condition. But after the changeover in the freezing condition, return to the scanning condition and scan the B-mode image again, and the image is changed to a B-mode image in a new range.



Observable range 60mm



Observable range 40mm

6.2.3 Selection of gain curve

Gain curve which shows the relation between the echo intensity and the brightness of B-mode image is set at Log (logarithmic). But, if necessary, it is possible to set at Linear (linear function) or S (S-curve).

Log : The degree of the brightness is proportional to the logarithm of the echo intensity. In the range width 50dB, it is possible to observe the echo image, from parts of weaker echo to parts of stronger echo. And by changing over the display range, the desired part is emphasized.
(Refer to "5.2.3 Changeover of display range" (p.6-6).)

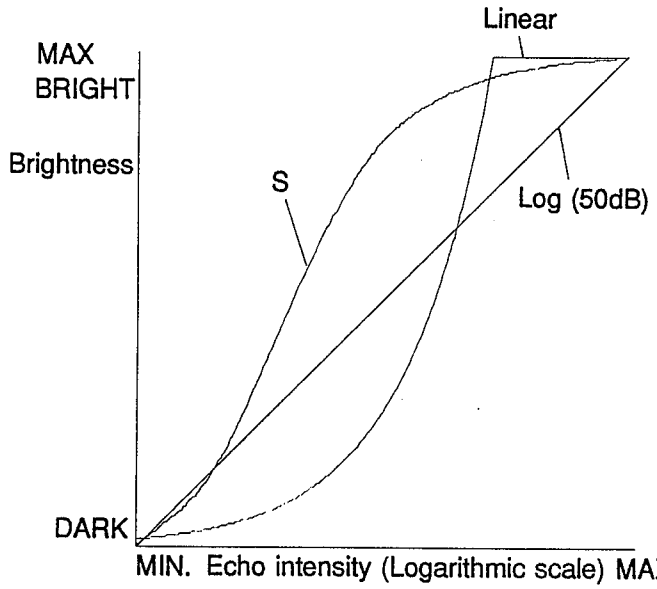
Linear : The degree of the brightness is proportional to the echo intensity.
Parts where the echo intensity is a little stronger than the middle intensity are displayed in a lot of brightness. But parts of stronger echo are displayed in white.

S : Parts where the echo intensity is a little weaker than the middle intensity are displayed in a lot of brightness. But other parts are displayed in a limited brightness.

* Initial setting : Log

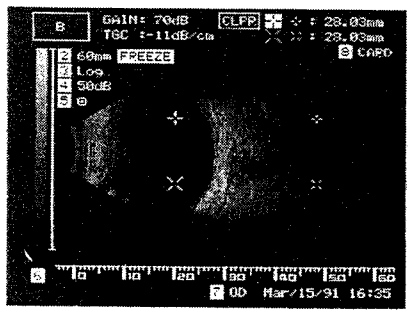
By pressing the numeric key [3], change over the gain curve.

* Whenever pressing the numeric key [3], the gain curve is changed over as follows.
Log → Linear → S → Log →・・・

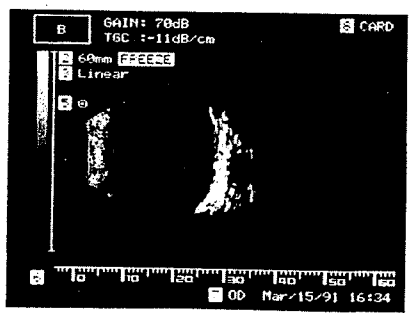


NOTE

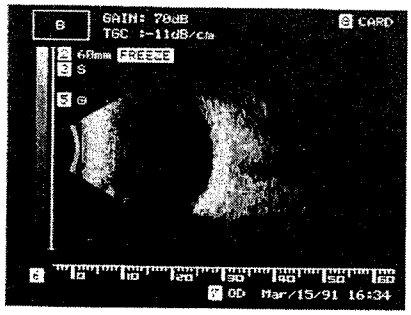
It is possible to select the gain curve in the freezing condition as well as in the scanning condition.



Log (50dB)



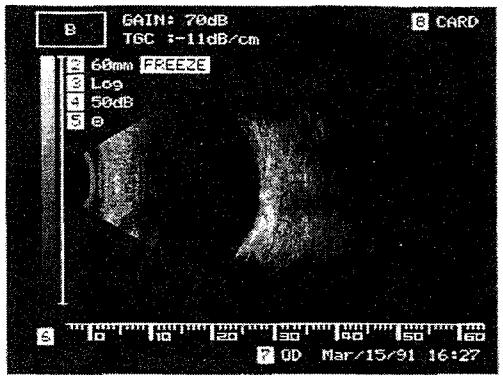
Linear



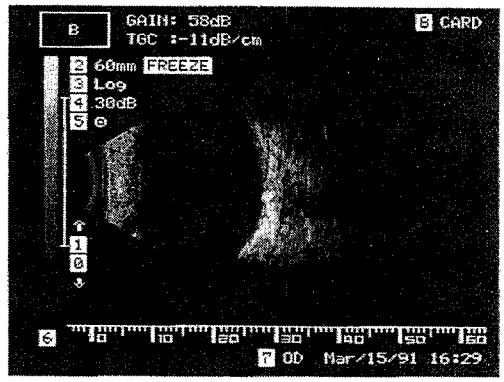
S

6.2.4 Change of display range

Normally, B-mode image is displayed in 64 gray scales according to the range of the echo intensity 50dB. If necessary, it is possible to change the display range. For instance, when the range width is cahnged to 30dB, the range of the echo intensity 30dB is displayed in 64 gray scales. By adjusting the range 30dB to the echo intensity (the gray scale on the display) in parts you want to observe, the contrast is clearer and you can observe the parts emphatically.

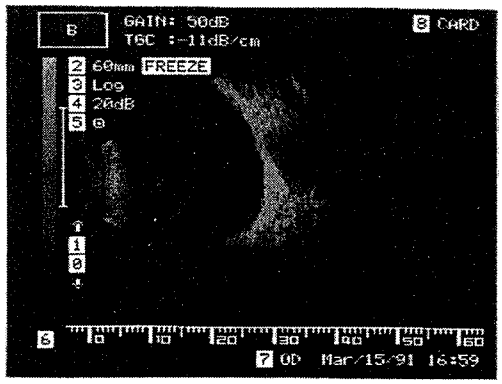


Range width 50dB

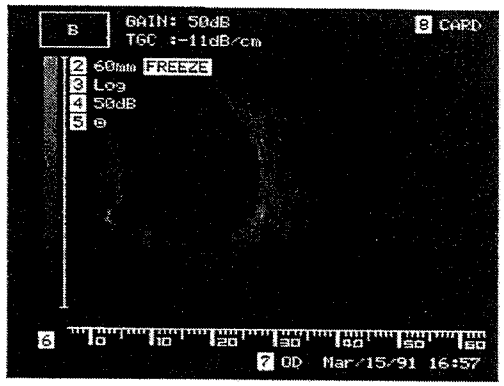


Range width 30dB

Changing the display range has the similar effect to decreasing the sensitivity by the GAIN control. And so, the frozen B-mode image can be simulated the image obtained when the sensitivity is decreased by the GAIN control.
In this case, the GAIN value displayed on the left upper of the monitor shows which sensitivity the value is equivalent to in the range width 50dB.



Simulated image



Real image in GAIN 50dB

* Initial setting : 50dB

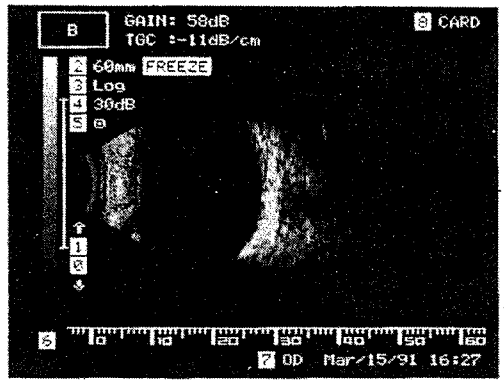
NOTE

When the gain curve is set at Linear or S, it is impossible to change the display range.

1) By pressing the numeric key [4], select the desired range width.

 * Whenever pressing the numeric key [4], the range width is changed over as follows.

 50dB → 40dB → 30dB → 20dB → 10dB → 50dB → ···

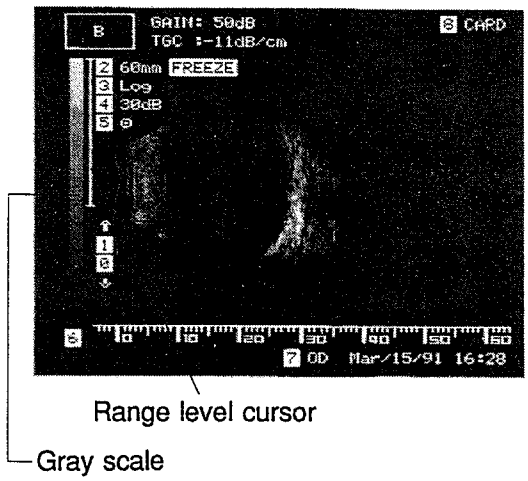


2) Move the range level cursor with the numeric keys [0] or [1], and set the desired range level.

 * The gray scale on the left side of the screen shows the depth of gray in the range width 50dB.

 Adjust the range level cursor to the depth in the part you want to observe minutely.

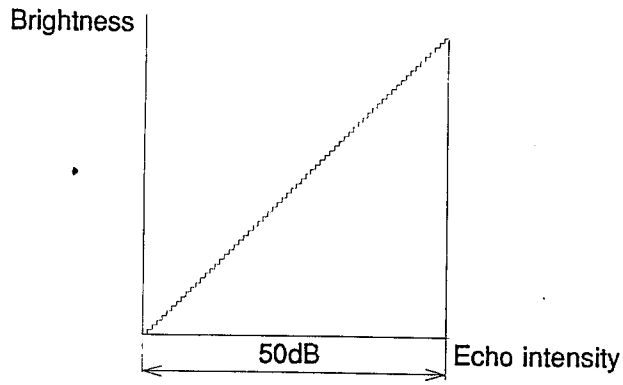
 * The range designated by the range level cursor is displayed in 64 gray scales. And the parts out of cursor are displayed in white or black.

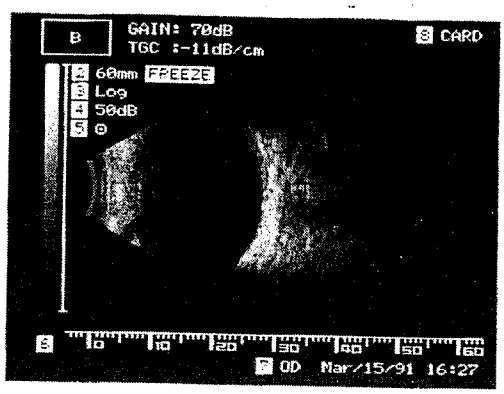


NOTE

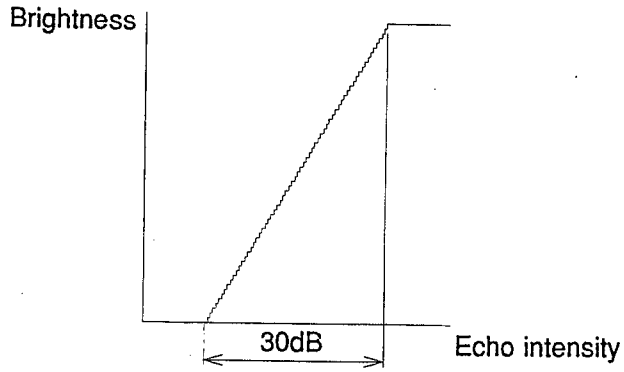
It is possible to change the display range in the freezing condition as well as in the scanning condition.

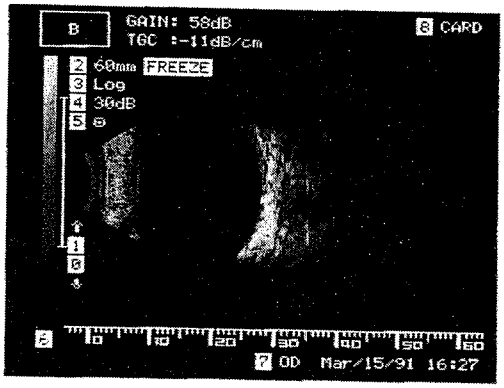
· Range width : 50dB



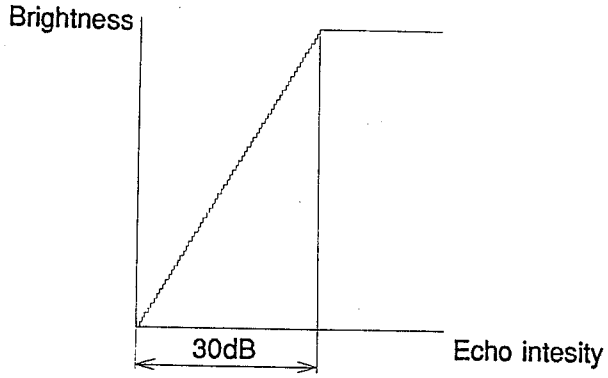


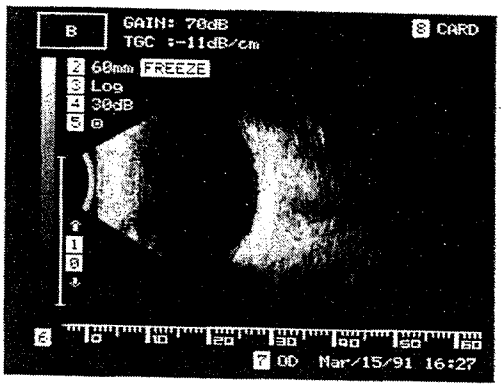
· Range width : 30dB, Range level : Middle echo



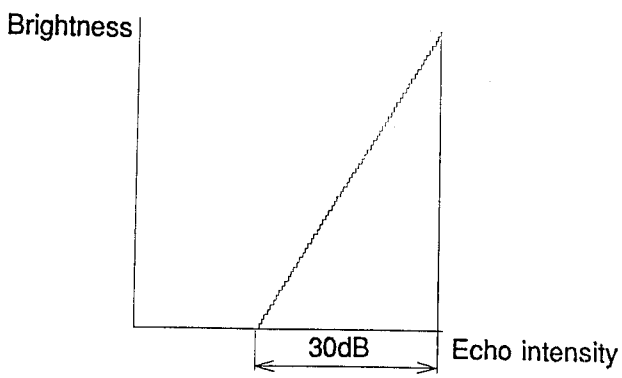


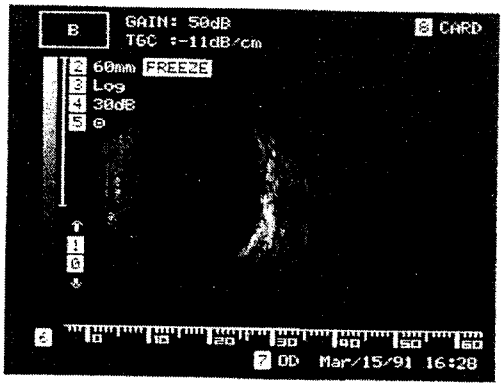
· Range width : 30dB, Range level : Weaker echo





· Range width : 30dB, Range level : Stronger echo



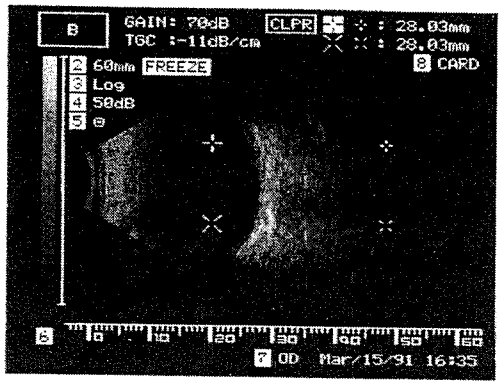


6.2.5 Operation of caliper function

US-3300 provides a caliper function to measure a distance between any 2 points on the B-mode image. By the use of large and small markers, plus (+, +) and cross (×, ×), 2 distances can be measured and displayed.

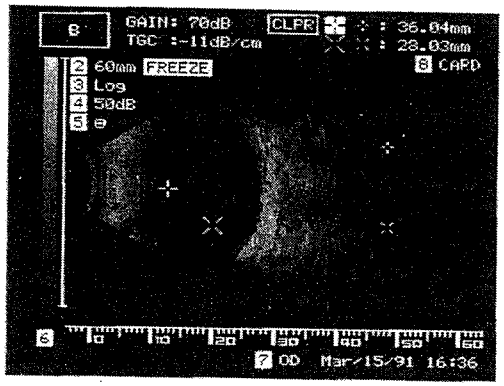
1) Press the [F1 CLPR] key.

 * Both the large and small markers (+, +, ×, ×) appear on the B-mode image.



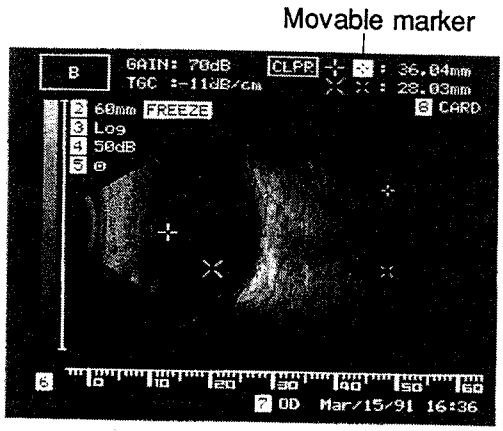
2) By pressing the arrow keys, move the large marker + to one end of the desired distance.

 * By pressing the arrow keys with the [SHIFT] key, the movement of the marker is made faster.



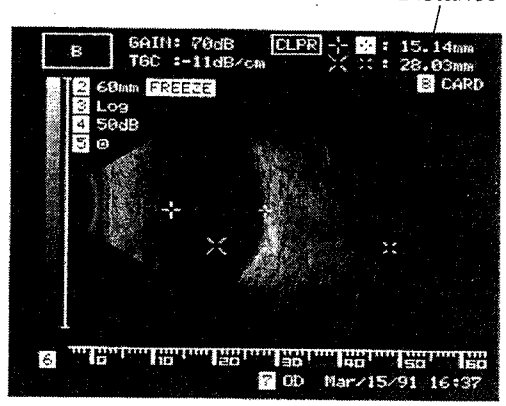
3) Press the [F1 CLPR] key.

 * The movable marker is changed over from the large marker + to the small marker +.



4) By pressing the arrow keys, move the small marker + to the other end of the desired distance.

* By pressing the arrow keys with the [SHIFT] key, the movement of the marker is made faster.
* The distance between 2 markers is displayed on the right upper of the monitor.



5) Press the [F1 CLPR] key.

* By use of the large and small markers, ×, ×, a distance can be also measured with the same procedures.

6) By pressing the mode key [B] or [CV], the caliper function is canceled and the B or CV-mode screen appears.

NOTES

1) The caliper function and the area or box function can not be used at the same time.
2) The ultrasonic velocity for the caliper and area functions is 1550m/s.

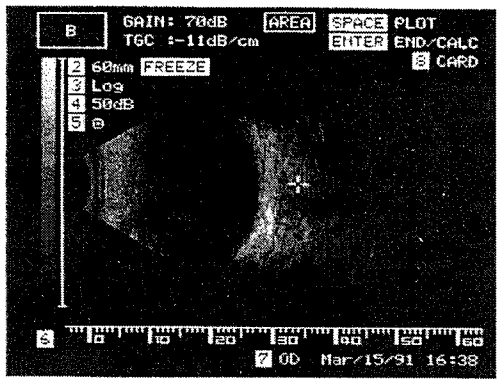
 When changing the ultrasonic velocity, refer to "6.8.3 Change of ultrasonic velocity" (p. 6-39).

6.2.6 Operation of area function

US-3300 provides the area function to obtain an area which is plotted on the B-mode image.

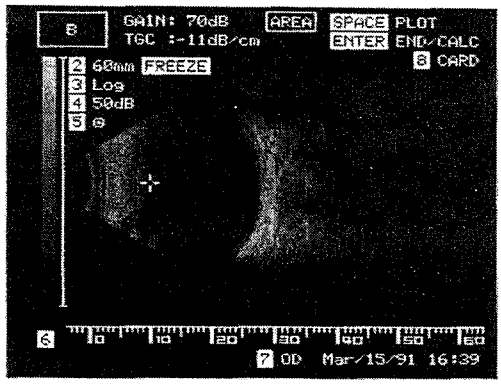
1) Press the F2 AREA key.

 * A marker + appears on the B-mode image.



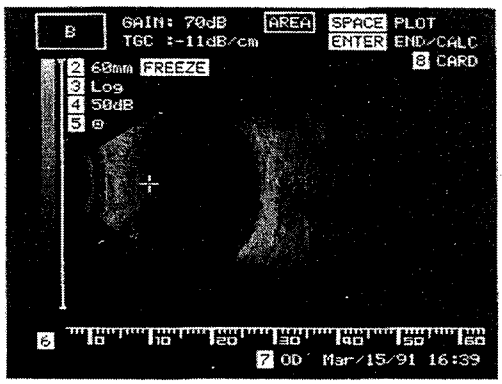
2) By pressing the arrow keys, move the marker + to the end of the desired area.

 * By pressing the arrow keys with the SHIFT key, the movement of the marker is made faster.



3) Press the space key [].

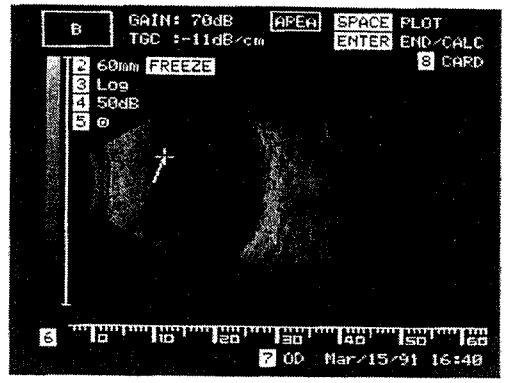
 * The dot appears on the marker +.



4) By pressing the arrow keys, move the marker + to the point you want to mark secondly.

5) Press the space key [].

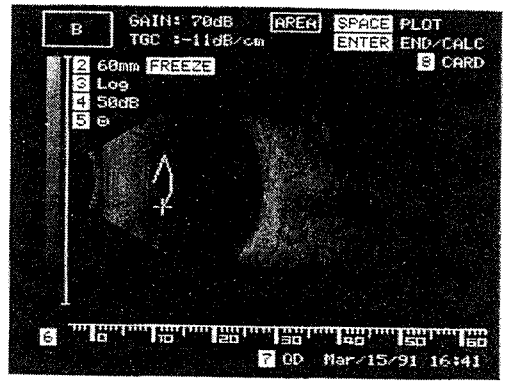
* The dot is plotted.



6) Plot the dots in order to enclose the desired area with the same procedures 4) - 5).

NOTE

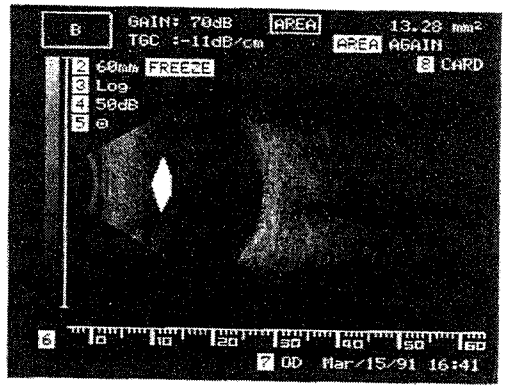
Be sure to plot the dots clockwise or counterclockwise.



7) After the last dot is marked, press the [ENTER] key.

* The last and first dots are plotted.

* The area plotted is obtained and displayed on the right upper of the monitor.



8) By pressing the mode key [B] or [CV], the area function is canceled and the B or CV-mode screen appears.

* In case of obtaining another area, return to the screen in the operating procedure 1) by pressing the [F2 AREA] key, and repeat the same procedures.

NOTES

1) The area function and the caliper or box function can not be used at the same time.

2) The ultrasonic velocity for the caliper and area functions is 1550m/s.

When changing the ultrasonic velocity, refer to "6.8.3 Change of ultrasonic velocity" (p. 6-39).

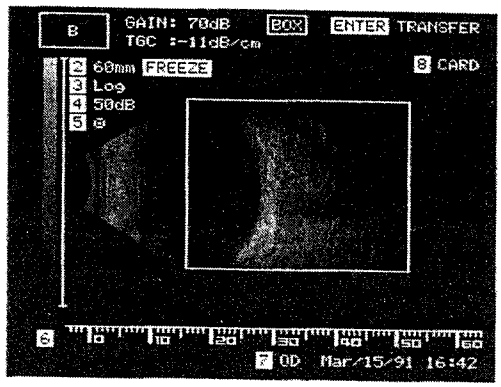
6.2.7 Operation of box function

Up to 4 B-mode images can be memorized and displayed. And any part of the B-mode image can be exposed double, and then memorized and displayed.

By memorizing the images in the various direction and conditions, comparing 4 images is possible and a part you want to observe minutely can be exposed.

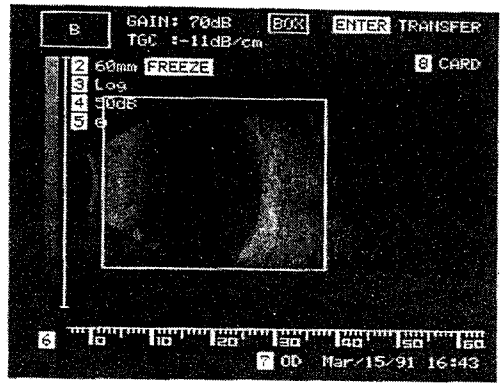
1) Press the [F3 BOX] key.

 * A box showing the memorizable area appears.



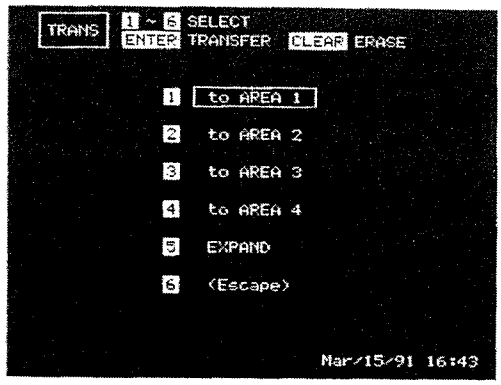
2) By pressing the arrow keys, move the box in order to enclose the desired part.

 * By pressing the arrow keys with the [SHIFT] key, the movement of the box is made faster.



3) Press the [ENTER] key.

 * The mode is changed over to the transfer mode.
 * If pressing the [ENTER] key by mistake, select <Escape> with the numeric key [6] or arrow key [↓] and press the [ENTER] key. The screen will return to its origin.



4) By pressing the numeric key [1] - [5] or arrow key [↓] or [↑], select the desired number.

[1] to AREA 1 : The image is transferred to the area 1 and memorized.

[2] to AREA 2 : The image is transferred to the area 2 and memorized.

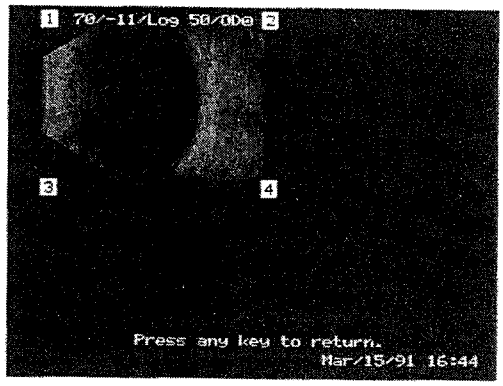
[3] to AREA 3 : The image is transferred to the area 3 and memorized.

[4] to AREA 4 : The image is transferred to the area 4 and memorized.

[5] EXPAND : The image is expanded, transferred and memorized.

5) Press the [ENTER] key.

* The B-mode image designated by the box is transferred and memorized according to your selection in the procedures 4).
* The GAIN value, TGC value, gain curve, range width, OD or OS and probe orientation are transferred and memorized with the image.
* By pressing the [CLEAR] key instead of the [ENTER] key, the memorized image at the designated area or expanded image are deleted.



NOTE

It is not possible to memorize the image at each area with the expanded image.

6) By pressing any key, the display returns to its origin (the display in the procedure 2)).

7) By pressing the mode key [B] or [CV], the box function is canceled and the B or CV-mode screen appears. By pressing the [F4 PAGE] key in the B or CV-mode, the memorized image is returned.

* By pressing the [F4 PAGE] key again, the B or CV-mode is returned again.

NOTE

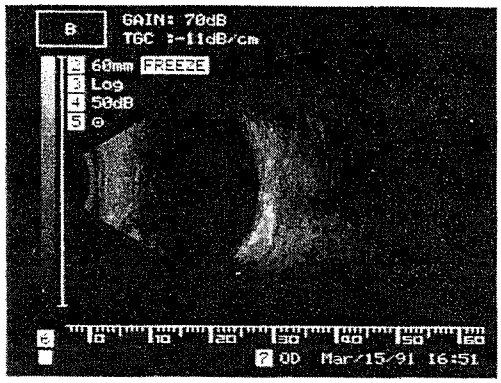
The box function and the caliper or area function can not be used at the same time.

6.2.8 Input of patient's name

It is possible to input the patient's name in the B or CV-mode.

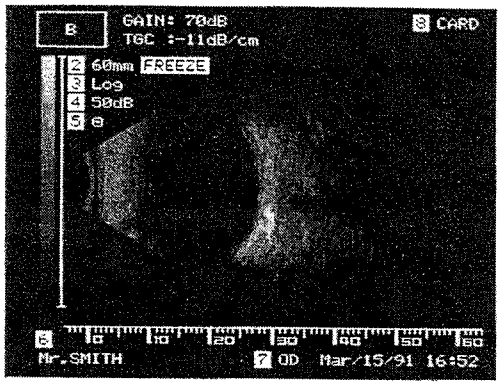
1) Press the numeric key [6].

 * The cursor is displayed at the left bottom on the monitor.



2) Input the patient's name with the alphabetic keys and press the [ENTER] key.

 * By pressing the alphabetic key with the [SHIFT] key, a small letter is inputted.
 * If inputting the wrong letter, press the [CLEAR] key.
 * A maximum of 20 letters can be inputted.



NOTE

When inputting the patient's data in the ID-mode, the patient's name can be displayed similarly.

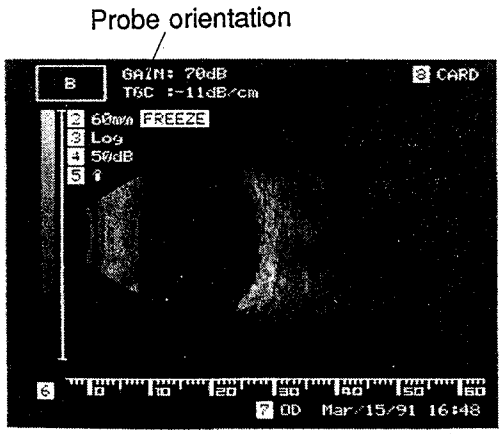
6.2.9 Input of probe orientation

It is possible to input the probe orientation in the diagnosis.

Initial setting : ▣ (right ahead)

Whenever pressing the numeric key [5], the mark is changed over the as follows.

▣, ↑, ↗, →, ↘, ↓, ↙, ←, ↖ ···

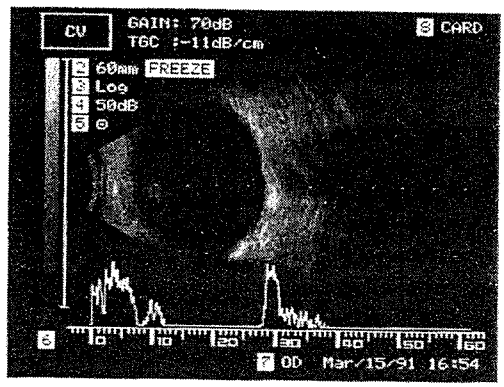


6.3 Operation of CV-mode

In the CV-mode, it is possible to display an A-mode waveform in any vector direction under the B-mode image.

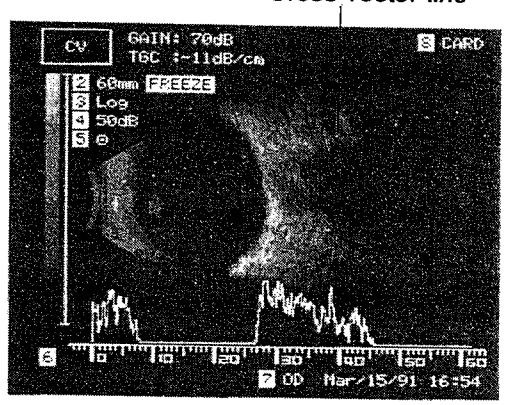
Change into the CV-mode. (Refer to "6.1.2 POWER ON and change of the mode" (p. 6-2).)

1) Scan the B-mode image.
 Refer to "6.2.1 Basic operation 1) - 5)" (p. 6-3).



Cross vector line

2) By pressing the arrow key [↓] or [↑], adjust the cross vector line to the desired direction on the B-mode image.
 * The A-mode waveform in the vector direction which the cross vector line shows is displayed.
 * By pressing the arrow key with the [SHIFT] key, the movement of the cross vector line is made faster.



NOTES

1) If the mode is changed over to the CV-mode with the mode key [CV] after freezing the B-mode image in the B-mode, the A-mode waveform in any vector direction of the image is displayed.
2) Changeover of observable range, selection of gain curve, change of display range, caliper function, area function, box function, input of patient's name, input of OD or OS, input of probe orientation and changeover of memorized image are possible in the CV-mode as well as in the B-mode.
3) As the cross vector line is a dotted line with increments of 5 mm, the simple measurement is also possible.

6.4 ID function

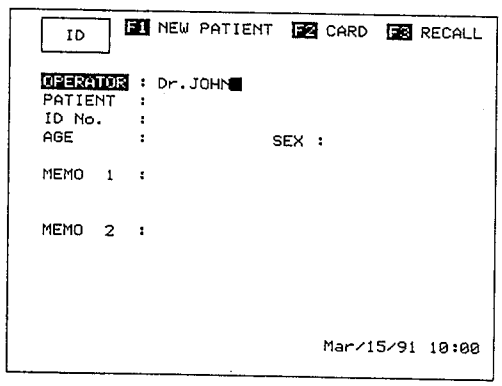
Change into the ID-mode. (Refer to "6.1.2 POWER ON and change of the mode" (p. 6-2).)

6.4.1 Input of patient's data

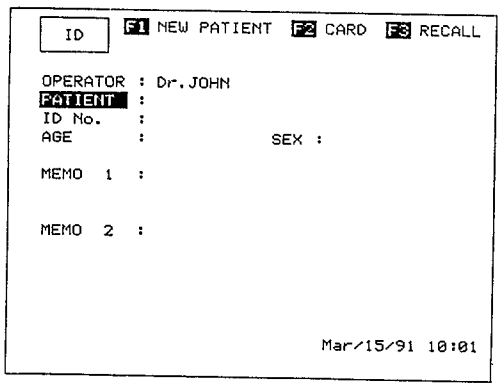
NOTE

When the mode is changed to the ID-mode by pressing the [ID] key, revesal letters (white letters on black background) indicated the item to be inputted.

1) Input the operator's name with the alphabetic keys.
 * By pressing the alphabetic key with the [SHIFT] key, a small letter is inputted.
 * If pressing the wrong letters, press the [CLEAR] key.
 * A maximum of 20 letters can be inputted.



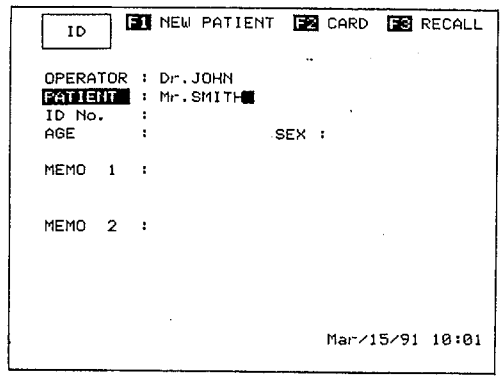
2) Press the [ENTER] key after the input of name is finished.
 * Reversal letters are changed from OPERATOR to PATIENT .
 * The operator's name is still memorized even if the power switch turns OFF ; therefore, if it is not necessary to change the operator's name, press the only [ENTER] key. If it is not necessary to change other items, press the only [ENTER] key.
 * When deleting the name already inputted, press the [CLEAR] key.



3) Input the patient's name with the alphabetic keys and press the [ENTER] key.

* A maximum of 20 letters can be inputted.

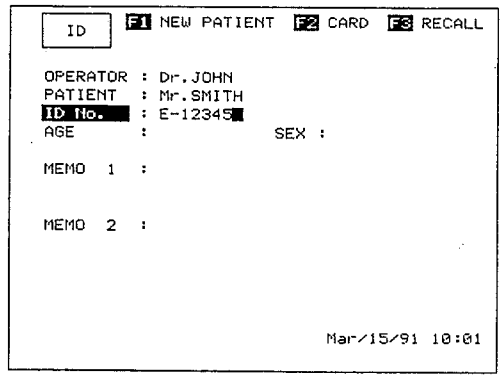
* The inputted patient's name is displayed on the left bottom of the display in any mode.



4) Input the patient's ID number with the numeric and alphabetic keys and press the [ENTER] key.

* A maximum of 20 letters can be inputted.

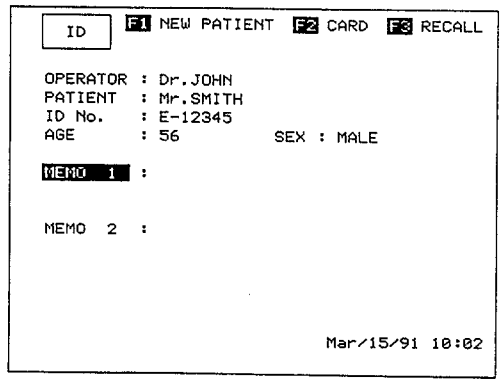
5) Input the patient's age with the numeric keys and press the [ENTER] key.



6) Input the patient's sex with the alphabetic keys and press the [ENTER] key.

7) If necessary, input a note in a blank of MEMO 1 with the alphabetic or numeric keys and press the [ENTER] key.

* A maximum of 3 lines can be inputted.



8) If necessary, input a note in a blank of MEMO 2 with the alphabetic or numeric keys and press the [ENTER] key.

* A maximum of 3 lines can be inputted.

9) The input of the patient's data is finished with the above procedures.

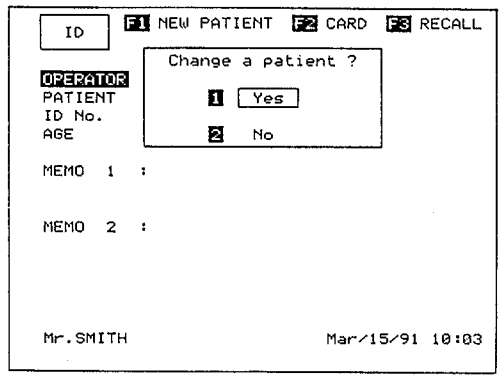
When you want to change the inputted items, move the reversal letters to the desired item with the [ENTER] or arrow key [↓] or [↑], and input the letters again with the above procedures.

* The former data can be returned by pressing [F3 BOX] key before pressing [ENTER] key.

6.4.2 New patient function

When diagnosing a new patient, it is convenient to delete the B-mode image, A-mode waveform, measured value and data of the last patient with the new patient function, but the operator's name is not deleted.

1) Press the [F1 CLPR] key.
 If pressing the [F1 CLPR] key by mistake, press the numeric key [2] and then [ENTER] key. The ID-mode is returned.



2) Press the [ENTER] key.
 * The mode is changed over to the B-mode.
 * All the data of the proper patient are deleted.

NOTE

Data to be deleted

Patient's name, ID No., age, sex, MEMO 1, MEMO 2, B-mode image, probe orientation, OD or OS and A-mode waveform, measured value, condition of measured eye, inputted value for IOL calculation (ACD value, A-constant and SF value are excluded.) and calculated value

* The operator's name, ultrasonic velocity, IOL formula and constant are not deleted.

6.5 Operation of A-mode

* The A-mode probe (optional accssory) is necessary.

Change into the A-mode. (Refer to "6.1.2 POWER ON and change of the mode" (p. 6-2).)

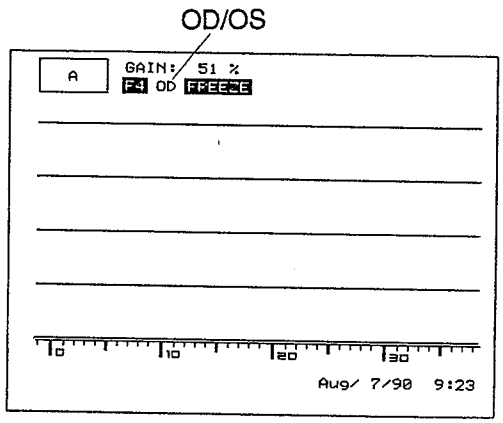
6.5.1 Basic operation

1) By pressing the F4 PAGE key, select the patient's eye to be diagnosed, right or left.

 * By pressing the F4 PAGE key, it is possible to change over between "OD" and "OS".

 OD : Oculus Dexter

 OS : Oculus Sinister

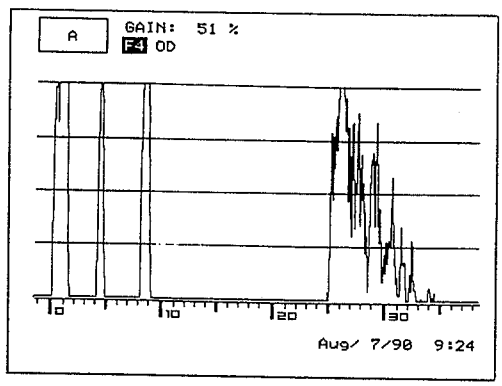


2) Depress the foot switch.

 * The instrument is in the measuring condition.

3) Touch the A-mode probe to the patient's eye.

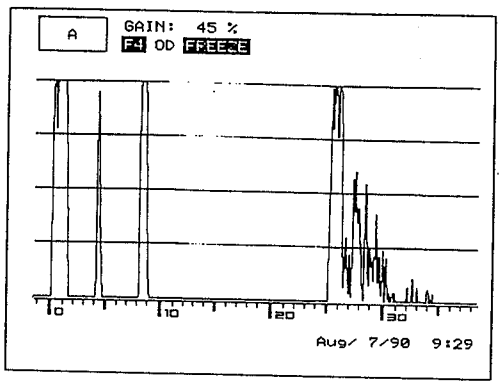
 * An A-mode waveform appears.



4) If necessary, adjust the sensitivity of the A-mode waveform with the GAIN control.

5) By depressing the foot switch, the A-mode waveform is frozen and displayed.

 * By depressing the foot switch again, the instrument is returned to the measuring condition.

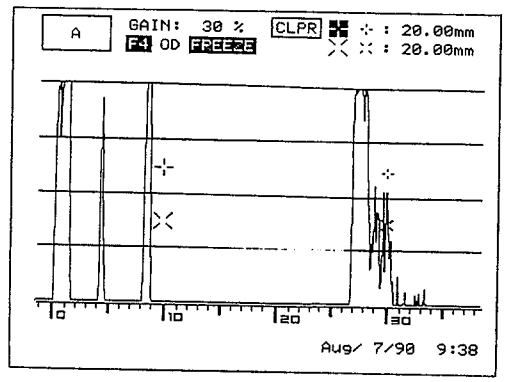


6.5.2 Operation of caliper function

US-3300 provides a caliper function to measure a horizontal distance between any 2 points on the A-mode waveform. By the use of large and small markers, plus (+, +) and cross (×, ×), 2 distance can be measured and displayed.

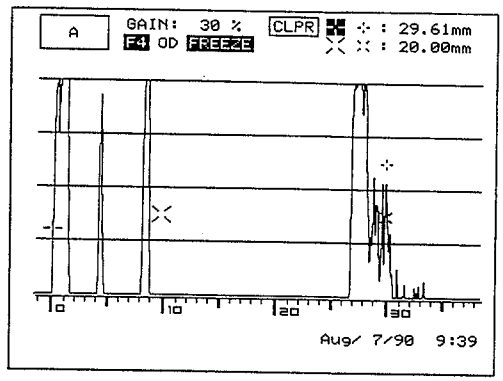
1) Press the [F1 CLPR] key.

 * Both the large and small markers (+, +, ×, ×) appear on the display.



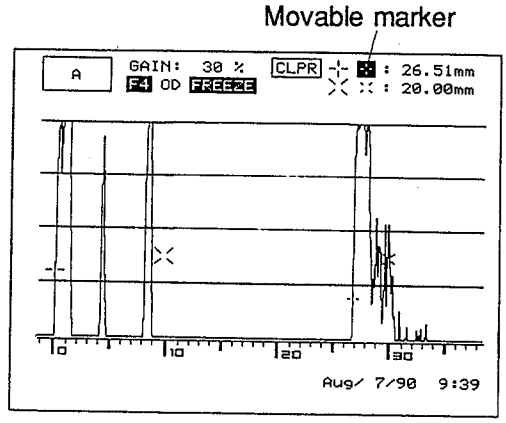
2) By pressing the arrow keys, move the large marker + to one end of the desired distance.

 * By pressing the arrow keys with the [SHIFT] key, the movement of the marker is made faster.



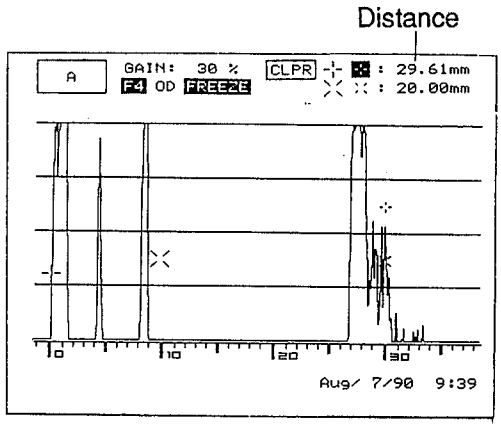
3) Press the [F1 CLPR] key.

 * The movable marker is changed over from the large marker + to the small marker +.



4) By pressing the arrow keys, move the small marker + to the other end of the desired distance.

* By pressing the arrow keys with the [SHIFT] key, the movement of the marker is made faster.
* The horizontal distance between 2 markers is displayed on the right upper of the monitor.



5) Press the [F1 CLPR] key.

* By use of the large and small markers, ×, ×, a horizontal distance can be also measured with the same procedures.

6) By pressing the mode key [A], the caliper function is canceled and the A-mode display appears.

NOTE

The ultrasonic velocity for the caliper function is 1550m/s.

When changing the ultrasonic velocity, refer to "6.8.3 Change of ultrasonic velocity" (p. 6-39).

6.6 Measurement of axial length

* The A-mode probe (optional accessory) is necessary.

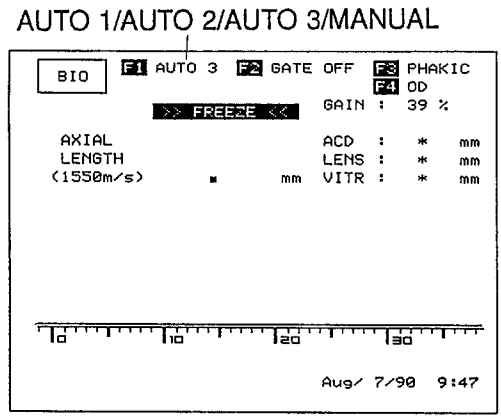
Change into the BIO-mode. (Refer to "6.1.2 POWER ON and change of the mode" (p. 6-2).)

6.6.1 Basic operation

1) By pressing the F1 CLPR key, select the method of measurement.

* Whenever pressing the F1 CLPR key, the method of measurement is changed over as follows.

AUTO 1 → AUTO 2 → AUTO 3 → MANUAL → AUTO 1 →···



* US-3300 reads the data over 10 times, performs the numerical processing, and then displays the measured value. (This is one measurement.)

In the MANUAL measurement, the measured value is displayed, and the measurement condition is kept on until the foot switch is depressed.

In the AUTO 1 measurement, the instrument judges the stability of measured values and A-mode waveform, and then freezes automatically.

In the AUTO 2 and AUTO 3 measurements, the instrument judges the stability of measured data and A-mode waveform, then the measured value is displayed. And the instrument judges the stability of 2 or 3 continuous measured value too, then freezes automatically.

And so, it is possible to obtain the stabler measured value in response to the movement of the eyeball and probe. We recommend to measure by the use of the AUTO 3 or AUTO 2 measurement.

* The designation of the method of measurement is memorized, even if the mode is changed or the power switch is turned OFF.

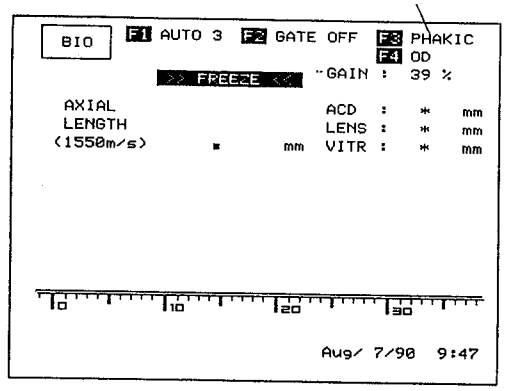
2) Make sure that the measuring condition of the patient's eye coincides to the display.

If it does not coincide, by pressing [F3 BOX] key, select it.

* Whenever pressing the [F3 BOX] key, the measuring condition is changed over as follows.

PHAKIC → APHAKIC → IOL → PHAKIC →···

PHAKIC/APHAKIC/IOL



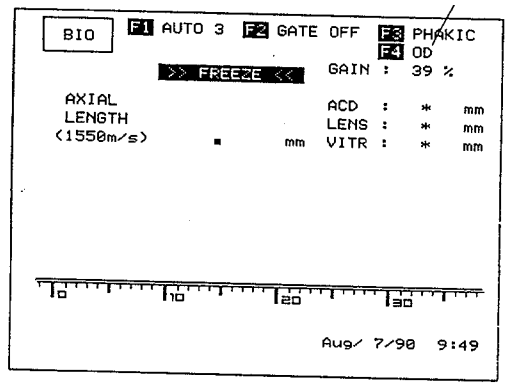
3) By pressing the [F4 PAGE] key, select the patient's eye to be diagnosed, right or left.

* By pressing the [F4 PAGE] key, it is possible to change over between "OD" and "OS".

OD : Oculus Dexter

OS : Oculus Sinister

OD/OS

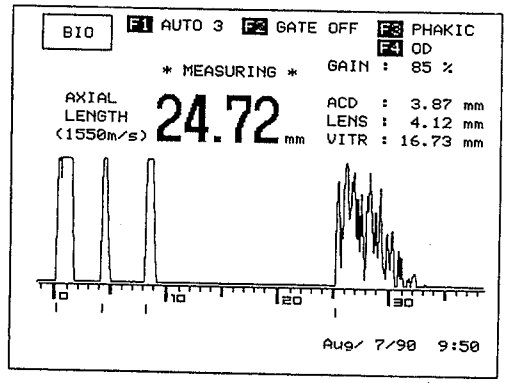


4) Depress the foot switch.

* The axial length measurement is started.

5) Touch the A-mode probe to the center on the cornea of the patient's eye.

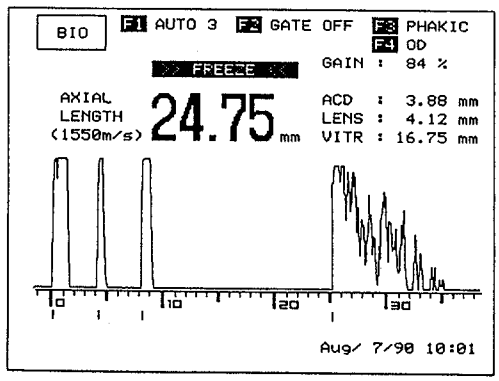
* An A-mode waveform appears and the measurement is made automatically.



◎ In the AUTO measurement, the measured values and A-mode waveforms are judged automatically and displayed.

* Short peep sounds tell that the measurement is finished.

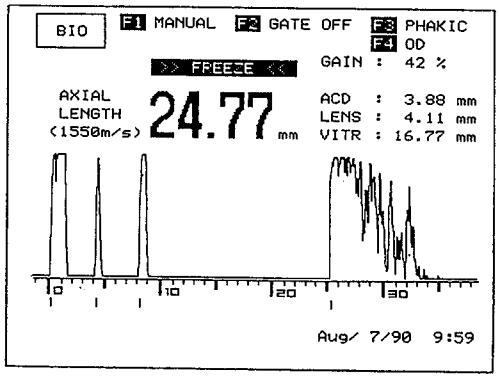
The axial length measurement is finished with the above procedures.



◎ In the MANUAL measurement, depress the foot switch when good A-mode waveform is displayed.

* The measured value is frozen.

The axial length measurement is finished with the above procedures.



* When measuring again, depress the foot switch.

NOTES

1) The ultrasonic velocities in the axial length measurement are as follows.

PHAKIC : 1550m/s (Axial length)

: 1532m/s (Anterior chamber)

: 1641m/s (Crystalline lens)

APHAKIC & IOL IMPLANTED EYE

: 1532m/s

* When changing the above values, refer to "6.8.3 Change of ultrasonic velocity" (p. 6-39).

* The ultrasonic velocity for the axial length measurement is displayed on the left side of the measured value.

2) As to the APHAKIC EYE, the anterior chamber depth (ACD) and the lens thickness (LENS) are not measured. As to the IOL IMPLANTED EYE, the lens thickness (LENS) is not measured but the anterior chamber depth (ACD) is measured. (ACD is distance from cornea to anterior IOL.)

6.6.2 Cautions on measurement

(1) Instruct the patient to gaze without moving eyes. (When the patient is strained, instruct him to relax.)

(2) Make sure that the probe is put on the center of the cornea.

The contacting position on the cornea is very important to achieve a correct measurement. Be careful never to press the cornea by the probe. And try to find the best position to obtain the best A-mode waveform by changing the probe contact angle with the cornea center. An A-mode waveform in good condition means that it has 3 echoes of cornea, crystalline lens anterior and posterior surfaces, and large and sharp rise up retina echo with small sclera echo. In the case that A-mode waveform display does not separate retina echo and sclera echo, adjust the sensitivity by turning the GAIN control counterclockwise.

Before freezing measured values make sure of the following items.

(a) Is a good A-mode waveform obtained?

(b) Does the probe contact the cornea properly?

(c) Is the patient's eye fixed?

(d) Are the measured values stabilized?

(Is the tolerance of the measured values within ±0.05mm?)

* If you try to measure quickly, you can not obtain the correct measured values. Calm down and have time to measure.

(3) When the measured values are displayed but the measurement is no stopped automatically in the AUTO measurements, make sure of the following items.

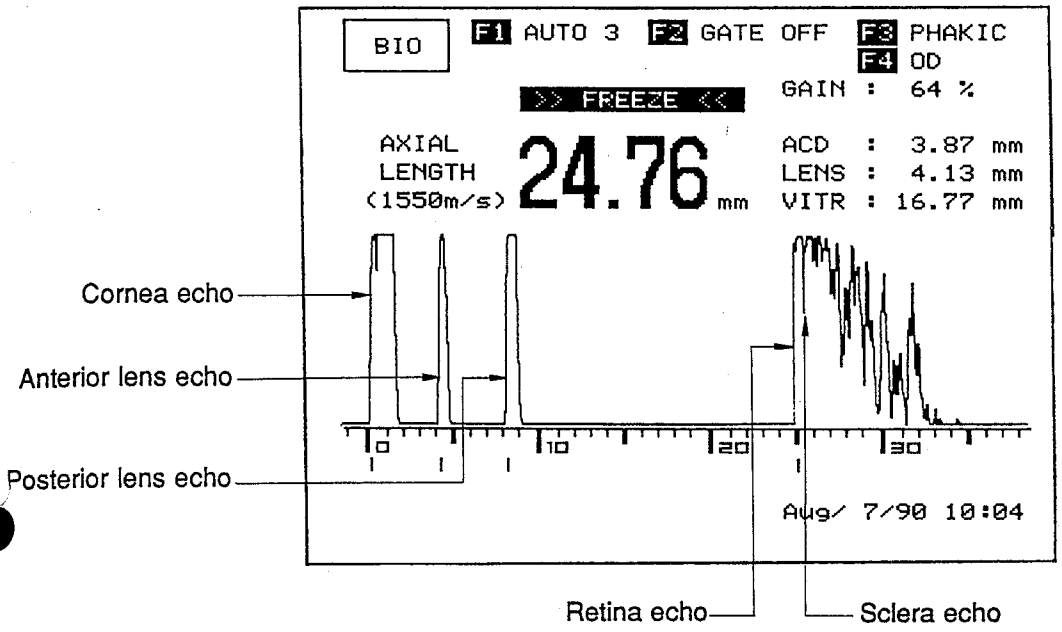
(a) Are the measured values stabilized?

(b) Is the retina echo rising up large and sharp?

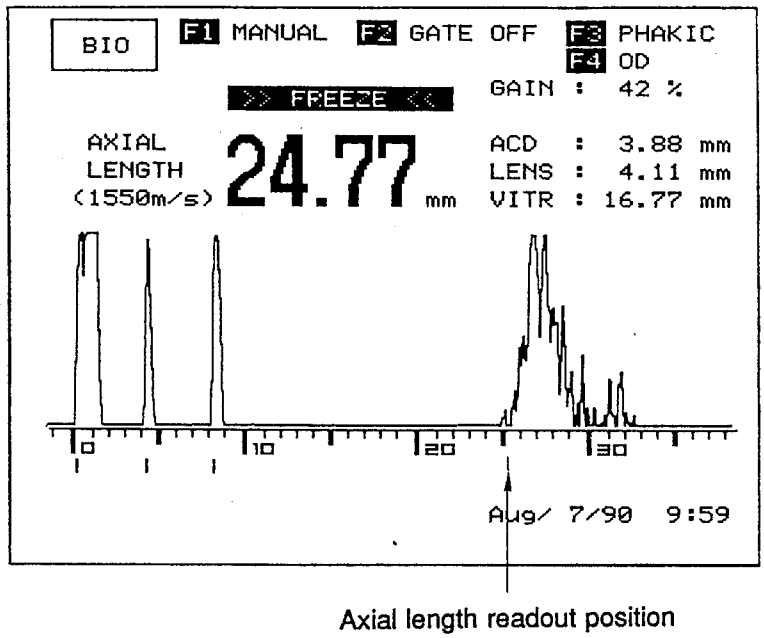
(c) Are the lens echoes large?

Referring to the A-mode waveform on the monitor, change the probe contact angle with the cornea center, and then measure again.

Good A-mode waveform



Bad A-mode waveform



6.6.3 Manual gate

In the following cases, measure by using the manual gate function.

(a) Manual gate for cornea

* This is used when the measurement is made by using an Eye Cap.

1) Press the [F2 AREA] key.

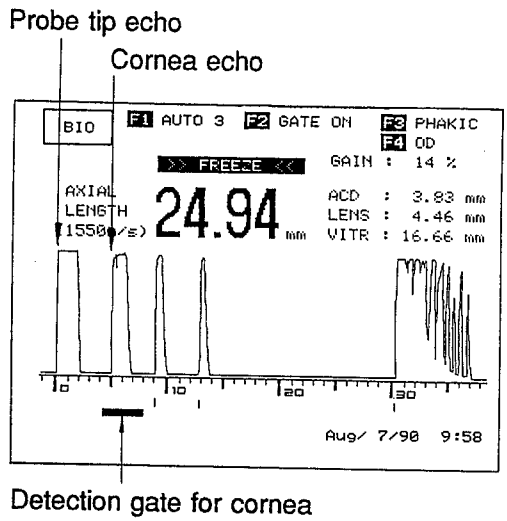
 * The display is changed over from "GATE OFF" to "GATE ON".

2) Press the arrow key [↑].

* The detection gate (the belt under the millimeter scale) for cornea echo appears.

3) By pressing the arrow key [↓] or [↑], change the position of the cornea detection gate.

* The cornea echo intended to be measured is positioned over the detection gate. And the measured value of axial length is a distance between the echo and the retina echo.



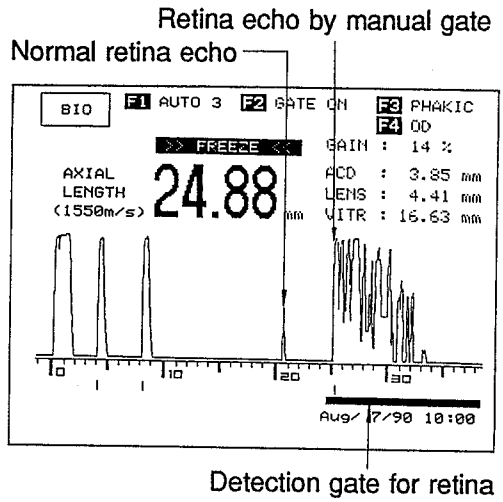
(b) Manual gate for retina

* This is used when there is an extra big echo in front of the actual retina echo.

(Including the case that there are many multiple echoes of IOL when measuring the IOL implanted eye.)

1) Press the [F2 AREA] key.

* The display is changed over from "GATE OFF" to "GATE ON".



2) Press the arrow key [←].

* The detection gate (the belt under the millimeter scale) for retina echo appears.

3) By pressing the arrow key [←] or [→], change the position of the retina detection gate.

* Position the left edge of the detection gate just left of the leading edge of the true retina echo. And the measured value of axial length is a distance between the echo and the cornea echo.

Any retina echoes appearing to the left of the detection gate will not be measured.

(C) Cautions on manual gate

(1) When moving the manual gate in the freezing condition, only the movement of the gate is done.

In this case, if the measurement is performed after releasing the freezing condition, it is possible to measure by using the manual gate.

(2) By pressing the [F2 AREA] key, the manual gate function is cancelled.

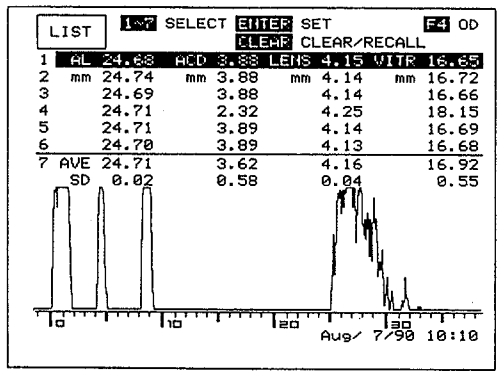
(3) By pressing the arrow key with the [SHIFT] key, the movement of the gate is made faster.

6.6.4 Confirmation and selection of measured values and A-mode waveform.

(a) This instrument memorizes 6 measured values and A-mode waveforms. And so, it is possible to observe them easily.

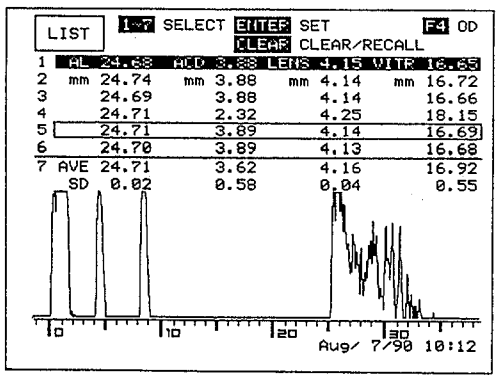
1) Press the [B10] key after freezing the measured values.

* The mode is changed over to the LIST mode.



2) Press the desired numeric key.

* ☐ is moved and the A-mode waveform of the designated number is displayed.



NOTE

The lower the number 1 through 6, the more recently the data was stored.

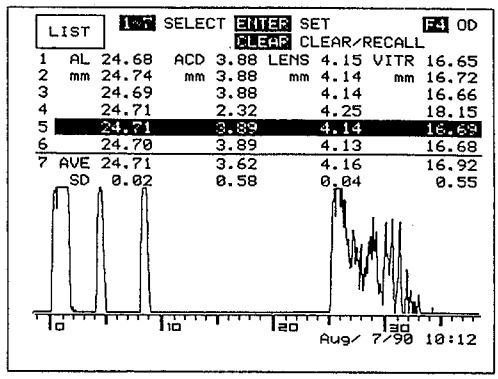
(b) When selecting the meassured values to calculate the refractive power of IOL, operate as follows.

1) Select the desired measured values by numeric keys [1] - [7].

 * The number 7 values show the average of the No. 1 - 6.

2) Press the [ENTER] key.

 * The values enclosed with ☐ is set for calculating and changed to the reversal letters.

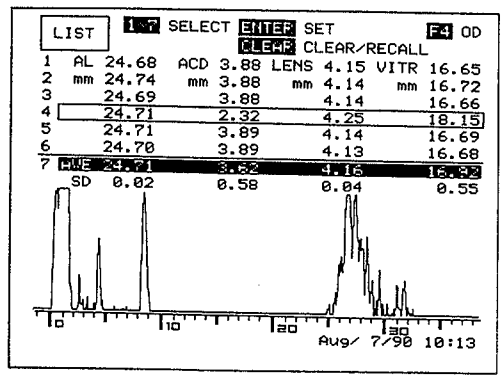


NOTES

1) The measured values in the reversal letters are used to calculate the refractive power of IOL.
 (When calculating the refractive power of IOL, these values are inputted automatically.)
 Normally, the number 1 values are displayed. And so, the last frozen values are used to calculate the refractive power of IOL unitl the number is changed.
2) If the measured value of axial length is "*" , it is impossible to calculate the refractive power of IOL.
 (By pressing the numeric key, ☐ can be moved. But even if pressing the [ENTER] key, the values are not set and the number in the reversal letters is not changed.)
3) If selecting No. 7, the average (AVE.) of No. 1-6 is used to calculate the refractive power of IOL.

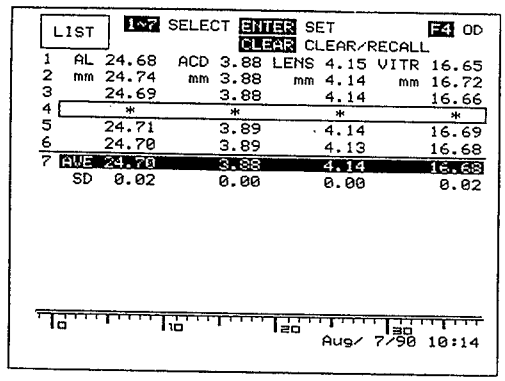
(c) When using the number 7 values to calculate the refractive power of IOL, delete the scattered values with following procedures and obtain the better standard deviation (SD).

1) By pressing the numeric keys [1] - [7], select the desired number.



2) Press the [CLEAR] key.

* The values enclosed with [] are deleted and marks "*" are displayed.
* Both the average and SD values are calculated and displayed.



NOTE

When deleting the measured values by mistake, press the [CLEAR] key again.

The measured values enclosed with [] are recalled.

6.7 Calculation of IOL refractive power

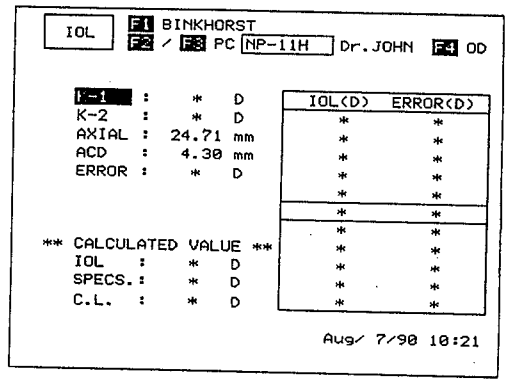
Change into the IOL-mode. (Refer to "6.1.2 POWER ON and change of the mode" (p. 6-2).)

6.7.1 Calculation

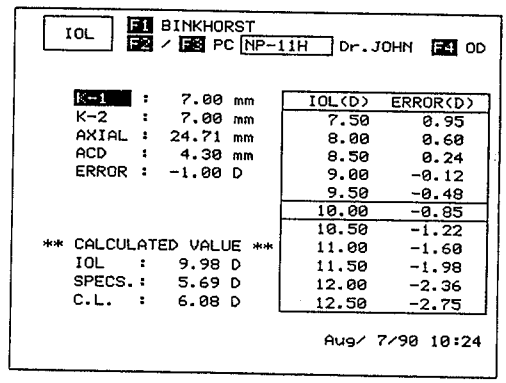
Input the neccessary data to calculate.

Whenever inputting the data, press the ENTER key.

* ACD value (BINKHORST formula), SF value (HOLLADAY formula) or A-constant (SANDERS--RETZLAFF-KRAFF-II formula) and measured value of axial length are inputted automatically. (Refer to NOTE 4).)



* The calculated value is displayed, after all the data are inputted.



* K-1 : Corneal curvature radius or corneal refractive power (possible to input either in mm or in diopters)

 K-2 : Corneal curvature radius or corneal refractive power (possible to input either in mm or in diopters) D=337.5/curvature radius (mm)

 ACD : Anterior Chamber Depth after surgery

 AXIAL : Axial length

 ERROR : Desired refractive power of correction lens after surgery

 A : A-constant

 SF : Surgeon factor

 IOL : IOL powers in diopters

 SPECS. : Spectacle power for aphakic correction

 C.L. : Contact lens power for aphakic correction

NOTES

1) As to the inputted data, by pressing the [ENTER] key, it is possible to move to the next item.
2) If you want to return to the previous item, press the arrow key [↑].
3) The table on the right of the calculated results shows the post operative refractive error (ERROR) when implanting the known refractive power of IOL.
4) The measured value of axial length to be inputted automatically is the value of the selected number in "6.6.4 Confirmation and selection of measured values and A-mode waveform" (p. 6-30).

6.7.2 Change of IOL formulas

1) By pressing the [F1 CLPR] key, the IOL formula is changed to the reversal letters. Whenever pressing this key, the formula is changed as folows.

 BIKHORST → HOLLADAY → SANDERS-RETZLAFF-KRAFF-II → BINKHORST →···

2) Select the desired formula and press the [ENTER] key.

 * The reversal letters are changed to the normal letters. If all necessary values are inputted, the calculation is made and calculated values are displayed. If the input is not completed, it is impossible to calculate.

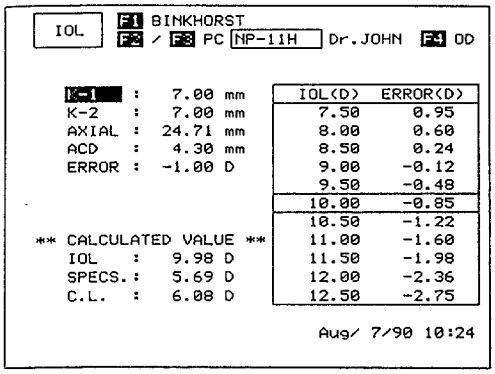
6.7.3 Change of IOL style

Press the [F3 BOX] key.

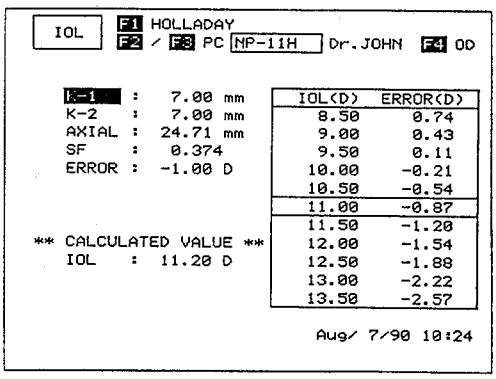
* By pressing the [F3 BOX] key, it is possible to change over the inputted IOL style in "6.8.1 Registration of IOL data" (p. 6-36).
* By pressing the [F2 AREA] key, it is possible to change over the IOL style in which the mark is inputted in "Registration of IOL data".
* ACD value, SF value or A-constant is changed to the value of its IOL style. If all necessary values are inputted, the calculation is made and the calculated value is displayed.

6.7.4 Examples of IOL refractive power calculations

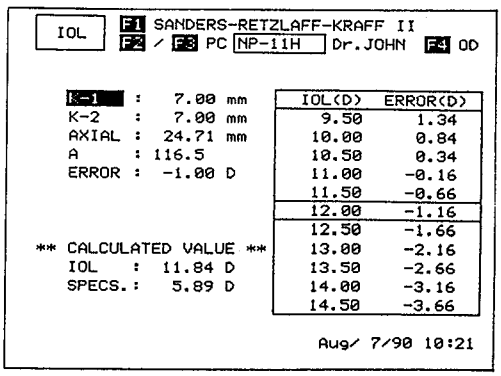
(1) Example of BINKHORST formula



(2) Example of HOLLADAY formula



(3) Example of SANDERS-RETZLAFF-KRAFF-II formula



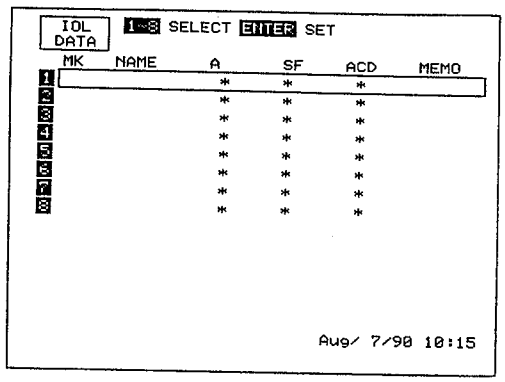
6.8 Functions

Change into FUNCTION-menu. (Refer to "6.1.2 POWER ON and change of the mode" (p. 6-2).)

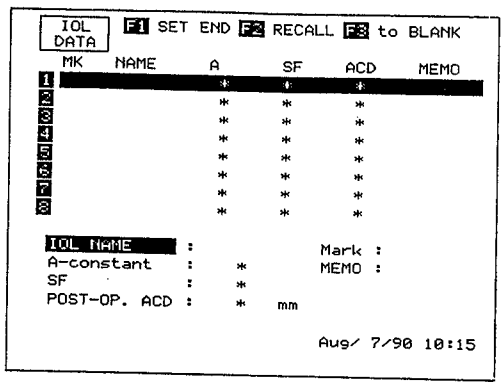
6.8.1 Registration of IOL data

1) Select "IOL data" by the numeric key and press the ENTER key.

 * The mode is changed to the IOL data registration mode.



2) Select the desired number by the numeric keys 1 - 8 and press the ENTER key.



3) Input the IOL style name (model name) by the alphabetic and numeric keys and press the ENTER key.

 * A maximum of 8 letters can be inputted.

4) Input the A-constant of its IOL and press the ENTER key.

5) Input SF value and press the ENTER key.

6) Input ACD value and press the ENTER key.

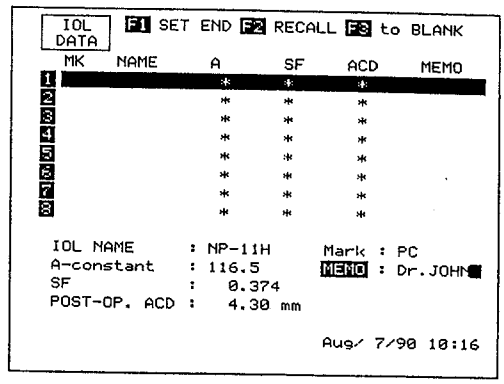
7) If necessary, input a mark by the alphabetic and numeric keys.

 * A maximum of 2 letters can be inputted.

 * By pressing the F2 AREA key, it is possible to change over the IOL style in which the mark is inputted.

8) If necessary, input a memo and press the [ENETR] key.

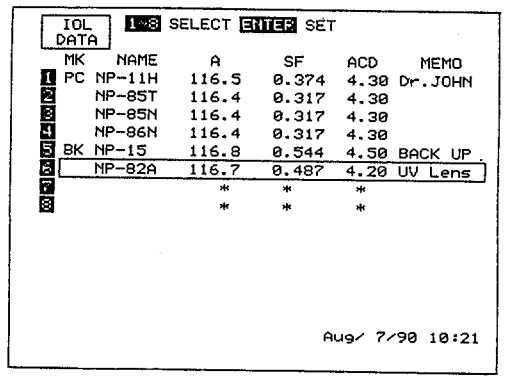
* A maximum of 8 letters can be inputted.



9) Press the [F1 CLPR] key.

* The inputted data are registered.

10) When inputting the data again, repeat the procedures 2) - 9).



NOTES

1) It is possible to register 8 IOL data.
2) By pressing the [F3 BOX] key, "*" or blank is inputted.
3) When changing the data, press the [F2 AREA] key before pressing the [ENTER] key, and the former data are re-called.

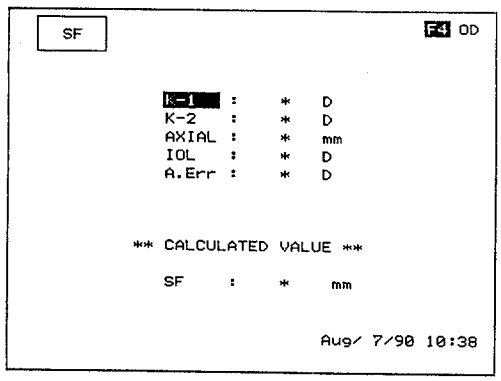
6.8.2 SF value reverse operating function

On the basis of the reverse operation Dr. Holladay, it is possible to reverse SF value by the refractive power of and actual refractive power after surgery.

* SF value is the compensated value of IOL for each operator.

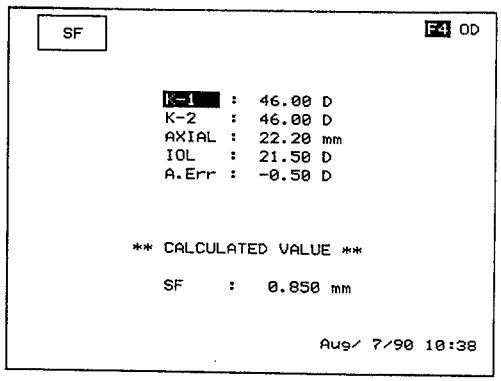
1) Select "HOLLADAY [SF]" by the numeric key and press the ENTER key.

* The mode is changed over to the SF reverse operation mode.



2) Whenever inputting the necessary data to the calculate by the numeric keys, press the ENTER key.

* After all the data are inputted, the calculated value is displayed.



K-1 : Corneal curvature radius or corneal refractive power (possible to input either in mm or in diopters

K-2 : Corneal curvature radius or corneal refractive power (possible to input either in mm or in diopters

D=337.5/curvature radius (mm)

AXIAL : Axial length

IOL : Implanted IOL power

A. Err. : Refractive power after surgery

SF : Surgeon factor

6.8.3 Change of ultrasonic velocity

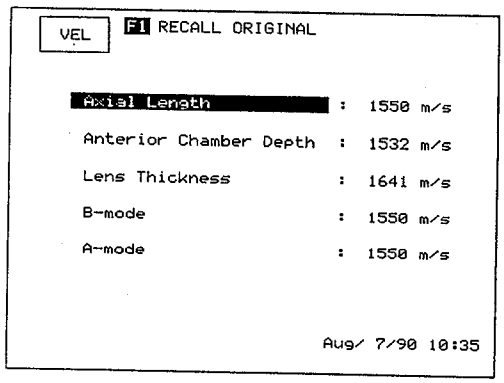
Normally, the ultrasonic velocities are set are follows.

AXIAL LENGTH MEASUREMENT

PHAKIC	Axial length :	1550m/s
	Anterior chamber :	1532m/s
	Crystalline lens :	1641m/s
APHAKIC :		1532m/s (same as anterior chamber of PHAKIC)
IOL IMPLANTED EYE :		1532m/s (same as anterior chamber of PHAKIC)
B-mode :		1550m/s
A-mode :		1550m/s

1) Select "Velocity" by the numeric key and press the ENTER key.

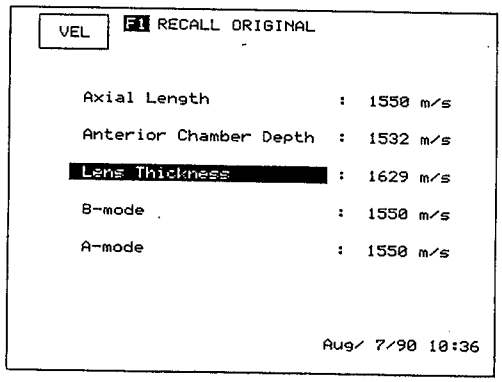
 * The mode is changed over to the velocity changing mode.



2) Select the desired velocity value by the ENTER key.

 * The reversal letters mean the changeable position.

3) Input a new value by the numeric keys and press the ENTER key.



NOTES

1) When recalling to its original value, press the F1 CLPR key.
2) When changing the velocity values of APHAKIC and IOL IMPLANTED EYE, change the velocity value of the Anterior Chamber Depth.

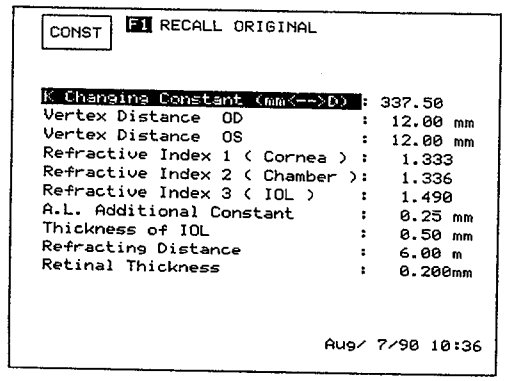
6.8.4 Change of IOL formula constant

Among the constants used in IOL formulas, the changeable constants and their original value are as follows.

K Changing Constant :	K constant (NOTE 4))	337.5
Vertex Distance OD :	Vertex distance of pseudophakic spectacles (OD)	12.00mm
Vertex Distance OS :	Vertex distance of pseudophakic spectacles (OS)	12.00mm
Refractive Index 1 :	Corneal refractive index (NOTE 3))	1.333...
Refractive Index 2 :	Aqueous and vitreous refractive index	1.336
Refractive Index 3 :	IOL refractive index	1.490
A.L. Additional Constant :	Estimated distance from the vitreoretinal interface to the visual cell layer	0.25mm
Thickness of IOL :	Thickness of implanting IOL	0.5mm
Refracting Distance :	Refracting distance	6m
Retinal Thickness :	Retinal thickness factor	0.200mm

1) Select "Constant" by the numeric key and press the ENTER key.

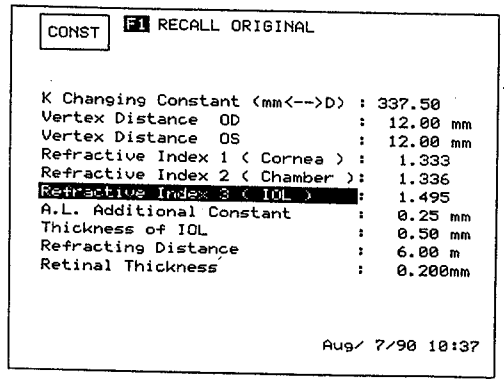
* The mode is changed over to the constant changing mode.



2) Select the desired constant by the ENTER key.

* The reversal letters mean the changeable position.

3) Input a new constant by the numeric keys and press the ENTER key.



NOTES

1) When recalling its original value, press the F1 CLPR key.
2) The necessary constants depend on the IOL formula. Refer to "8 IOL formulas" (p. 8-1)
3) As to the Refractive Index 1, 4/3 (=1.333...) is its original value.
 When recalling its original value, press the F1 CLPR key.
4) As to the K constant (KC), this instrument converts the units for K-1 and K-2 on the basis of the following formula. (mm ↔ D)

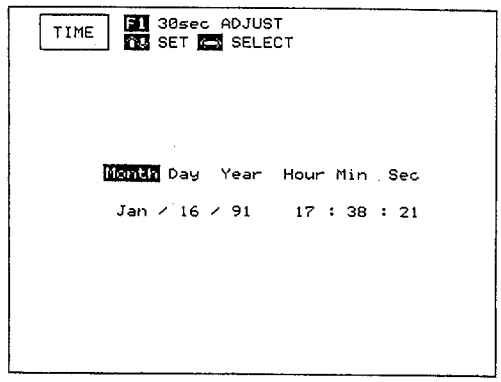
 [D]=KC/[mm]

 KC=337.5

6.8.6 Setting time and date

1) Select "Time Set" by the numeric key and press the [ENTER] key.

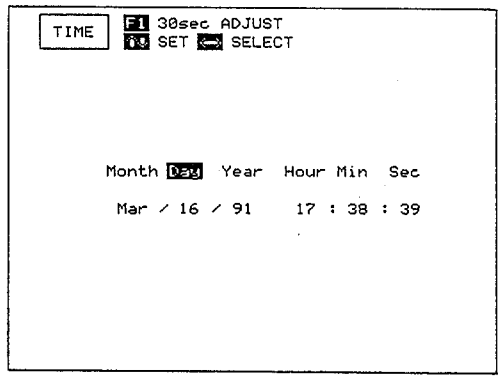
 * The mode is changed over to the time adjusting mode.



2) Set [Month] by the arrow key [↓] or [↑], and press the arrow key [→].

 * The reversal letters are changed over to the next item.

3) Set [Day] by the arrow key [↓] or [↑], and press the arrow key [→].



4) Set [Year] by the arrow key [↓] or [↑], and press the arrow key [→].

5) Set [Hour] by the arrow key [↓] or [↑], and press the arrow key [→].

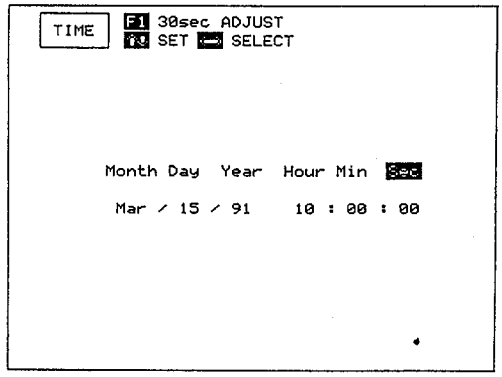
 * Hour is indicated in 24 hours.

6) Set [Minute] by the arrow key [↓] or [↑], and press the arrow key [→].

7) Set [Second] approximately by the arrow key [↓] or [↑].

8) Set [Second] by the [F1 CLPR] key.

 * By pressing the [F1 CLPR] key,
 N min. 0-29sec. is changed to N min. 0 sec. and N min. 30-59 sec. is cahnged to N+1 min. 0 sec.



NOTE

Even the power switch is turned OFF, the timepiece is kept running by batteries inside the instrument.

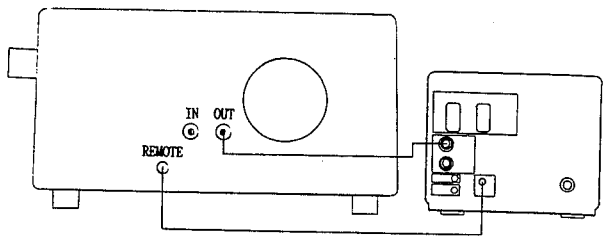
6.9 Preservation of image

It is possible to print out the images with the video printer (optional accessory) and record/play back them with the video cassette recorder.

6.9.1 Video printer (optional accessory)

<How to connect the video printer>

1) Connect the video signal cable to the video output connector on the rear panel and the video input terminal on the video printer.



2) Connect the remote control cable to the remote control connector on the rear panel and the remote terminal on the video printer.

<How to print out>

1) Turn the power button on the video printer ON.

2) By pressing the [PRINT] key or the print button on video printer, the image on the monitor is printed out.

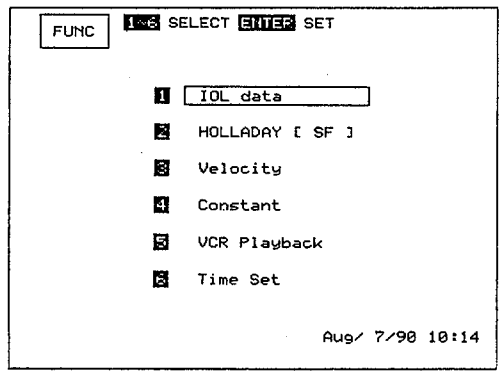
6.8.5 Playback of image

The image recorded with the video cassette recorder can be played back on the monitor of this instrument.

1) Confirm that the video input connector on the rear panel is connected to the video output terminal on the video cassette recorder by the video signal cable.

 * For the way to connect the video cassette recorder, refer to "6.9.2 Video cassette recorder" (p.6-45).

2) Select "VCR Playback" with the numeric key and press the [ENTER] key.



3) Set the video cassette recorder to play back.

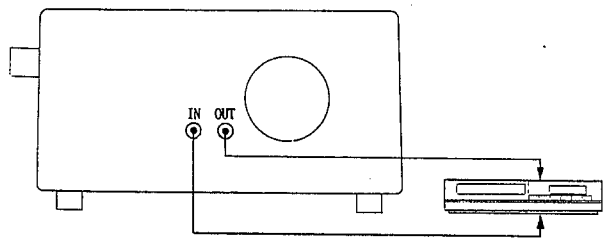
 * The image is played back on the monitor.

4) By pressing any key but the [PRINT] key, the VCR Playback function is canceled.

6.9.2 Video cassette recorder

<How to connect the video cassette recorder>

1) Connect the video signal cable to the video output connector on the rear panel and the video input terminal on the video cassette recorder.



2) Connect the video signal cable to the video input connector on the rear panel and the video output terminal on the video cassette recorder.

<How to record>

When the video cassette recorder is set to record, the image on the monitor can be recorded.

* For the playback of the images recorded with the video cassette recorder, refer to "6.8.5 Playback of image" (p. 6-42).

6.10 Test piece

* The A-mode probe (optional accessory) is necessary.

Test piece is used to confirm the operations and measurement values.

1) Put a drop of water on the A-mode probe tip.

2) Put the probe on the square face of the test piece perpendiculary.

3) Measure the test piece in accordance with "6.6.1 Basic operation" (p. 6-23).

 If the measured values are within the range indicated on the test piece, the instrument works normally.

NOTES

1) Use the test piece at the room temperature 20°C (68°F).
2) Set the measuring condition at "PHAKIC" and then measure.
3) When measuring the test piece, set ultrasonic velocity of the axial length at 1550m/s. (Refer to "6.8.3 Change of ultrasonic velocity" (p. 6-39).)

6.11 File card

The data which can be saved into the file card (optional accessory) is Measured data, IOL data, etc.

A maximum of 99 data can be saved into the file card. (The number of data which can be saved practically depends on the quantity of data.)

6.11.1 Cautions on handling file card

(1) Never pull the file card out of the instrument during the processes of initializing, saving, loading and deleting.

(2) Be sure to insert the file card with the side marked "MEMORY CARD" up.

(3) Be sure to insert the file card when the POWER switch is in the ON position.

(4) Keep the file card away from the strong shocks. Never bend, drop, put the heavy thing on it, etc.

(5) Keep the file card away from the high temperature and moisture conditions.

(6) Keep the file card away from the direct sunlight.

(7) Never put water on the file card.

(8) Be sure to keep the file card into the attached case so as to protect the terminal from the foreign body and static electricity, when it is not used.

(9) Extreme care must be given to handling this file card in the dry season etc. Because the file card is easily affected with the static electricity.

6.11.2 Replacement of battery

The battery of the file card is a lithium one (2325-type).

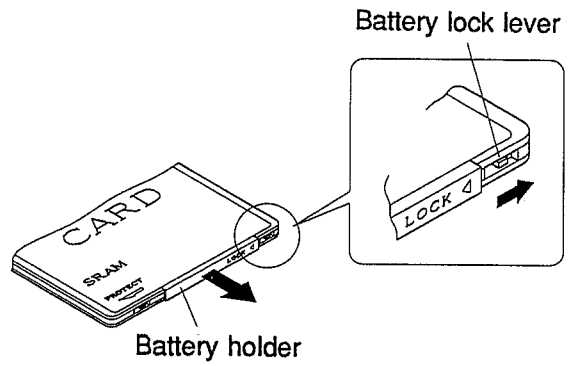
As the battery is not set into the file card in the shipment, set the attached battery before using.

As "CARD BATTERY is low." means that the battery is getting low, replace with a new one as soon as possible.

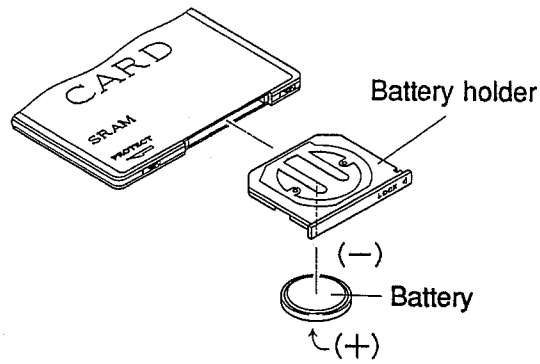
* The battery of the file card (memory capacity 128KByte) has about 4 years to live and the battery of the file card (memory capacity 1MByte) has about 1 year to live.

1) Slide the battery lock lever outside to release the lock.

2) Pull the battery holder forward.



3) Set a battery into the battery holder with the "-" pole toward the holder.
(The "+" pole turns down.)



4) Insert the battery holder taking care not to drop the battery.

5) Slide the battery lock lever inside to lock.

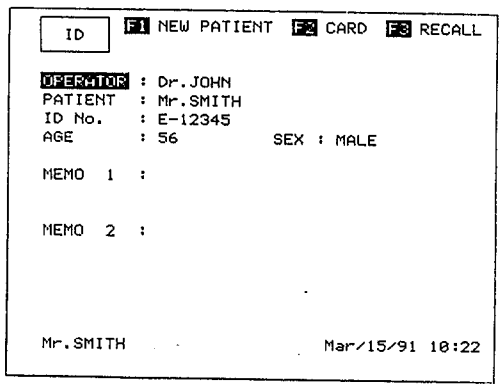
NOTE

If the battery is replaced in the condition that the file card is pulled out of the instrument, the saved data may be broken down. The replacement of battery should be done when the instrument is in the ON position with the file card in.

6.11.3 Inserting file card

1) Press the [ID] key.

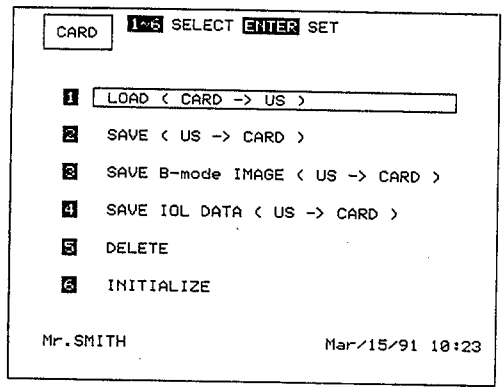
 * The mode is changed over to the ID-mode.



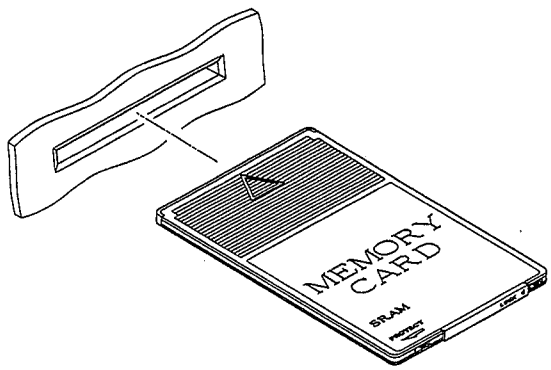
2) Press the [F2 AREA] key.

 * The menu of file card appears.

 * In the B-mode or CV-mode, by pressing the numeric key [8] the menu of file card appears.



3) Firmly insert the file card into the card slot with the side marked "MEMORY CARD" up.



6.11.4 Initialization of file card

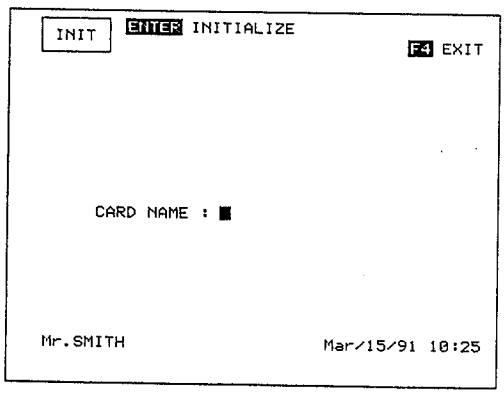
As a new file card can not be used in the state it is, set the battery and enter the information characteristic of this instrument before using. (Entering the information characteristic of this instrument to the file card is called "Initialization of file card" .)

Although all saved data will be deleted, the used file card can be initialized again.

1) Change the mode to the ID-mode and insert the file card. (Refer to "6.11.3 Inserting file card" (p. 6-49).)

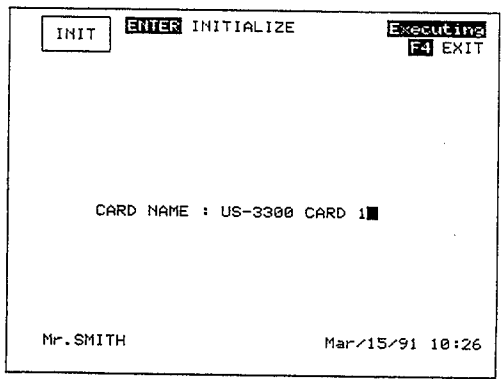
2) Select "INITIALIZE" by the numeric key and press the [ENTER] key.

 * The mode is changed over to the initializing mode of file card.



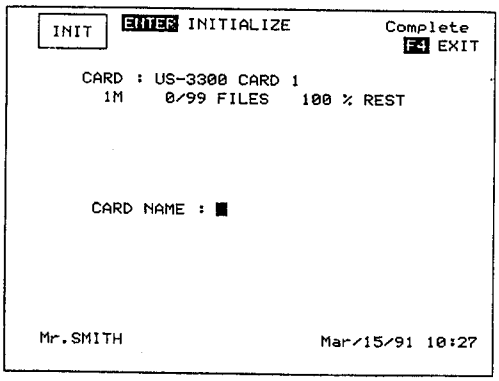
3) Input the desired card name by the alphabetic and the numeric keys and press the [ENTER] key.

 * A maximum of 20 letters can be inputted.



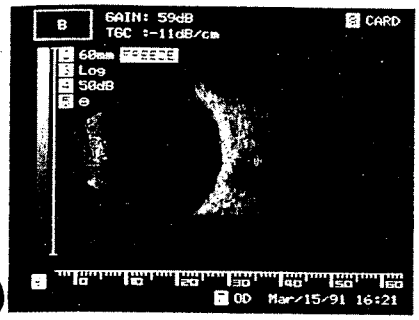
4) After it is complete to initialize the file card, the inputted card name is displayed on the CARD column.

 By pressing the [F4 PAGE] key, the menu screen of the file card appears.

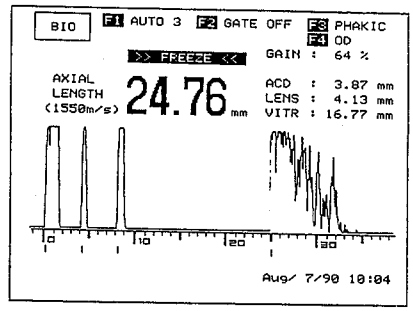


6.11.5 Save of measured data

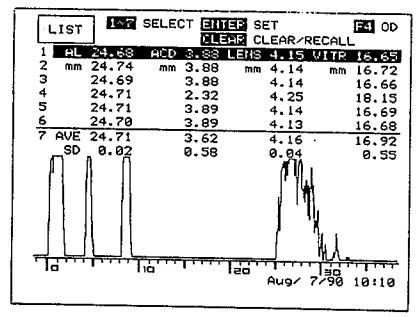
The measured data which can be saved into the file card is as follows.



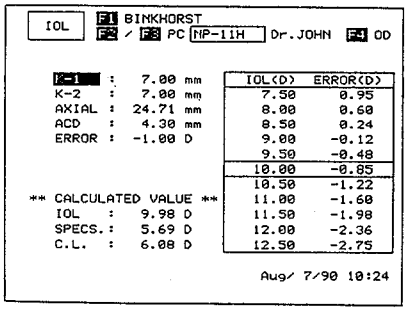
B-mode image



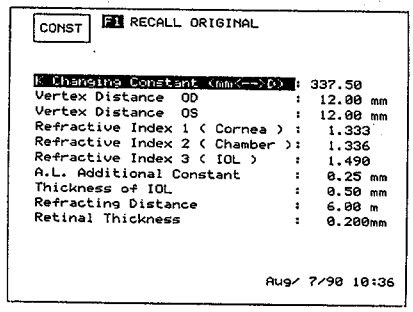
A-mode waveform (A, BIO)



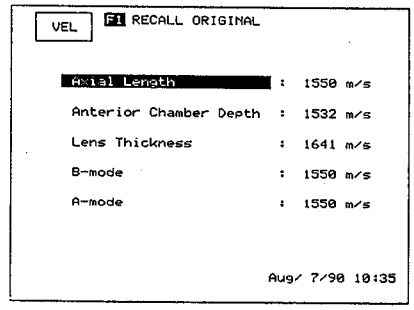
Measured value



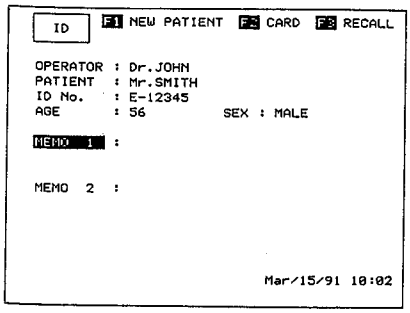
Calculated refractive power of IOL



Constant in IOL formula



Ultrasonic velocity

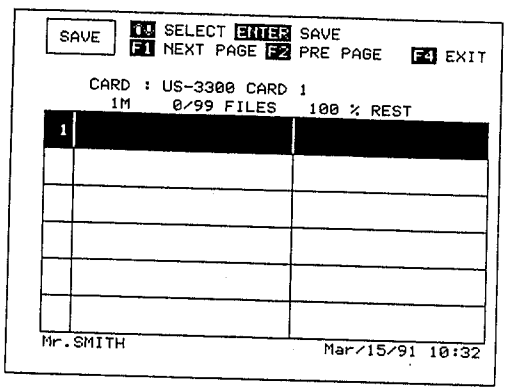


Patient's data

1) Change the mode to the ID-mode and insert the file card. (Refer to "6.11.3 Inserting file card" (p.6-49).)

2) Select "SAVE [US → CARD]" by the numeric key and press the ENTER key.

* The mode is changed over to the save mode of measured data.

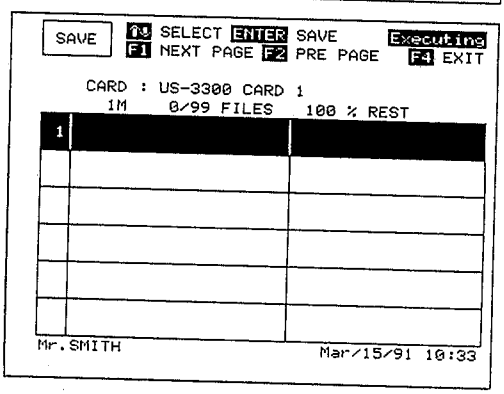


3) Press the ENTER key.

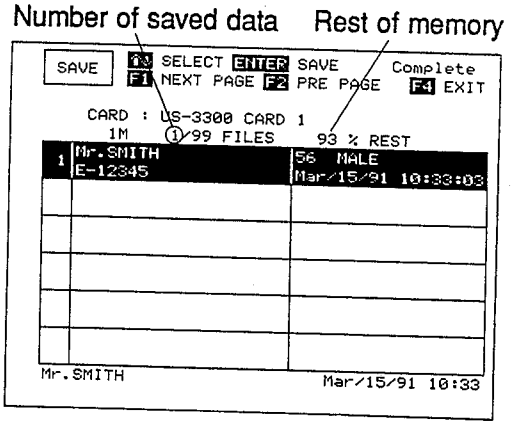
The data can be saved.

Meanwhile, "Executing" is displayed on the right upper of the monitor.

* When changing with the saved data, move the cursor by the arrow key ↓ or ↑ and press the ENTER key. Sets, 6 data per set, are displayed in order by pressing the F1 CLPR or F2 AREA key.



4) After it is complete to save measured data, the patient's name, ID No., age, sex, and date and time of the save are displayed on the list of saved data.



NOTE

If the patient's data is not preset, only date and time are displayed.

We recommend to input the patient's data to distinguish each saved data.

This function is finished with this step.

By pressing the F4 PAGE key, the menu screen of the file card appears.

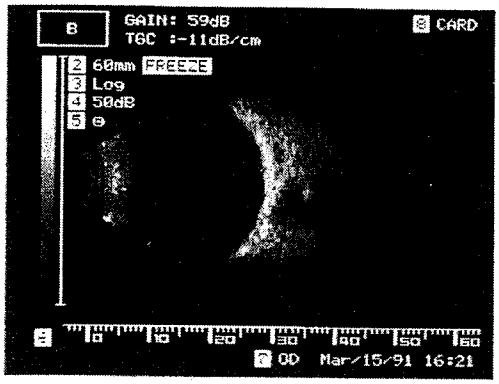
NOTE

The 128K Byte file card can save only one set of the measured data with B-mode image.

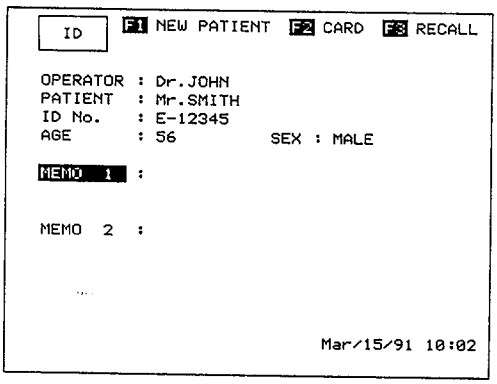
We recommend to use the 1M Byte file card for saving measured data with B-mode image.

6.11.6 Save of B-mode image

B-mode image and patient's data can be saved into the file card.



B-mode image

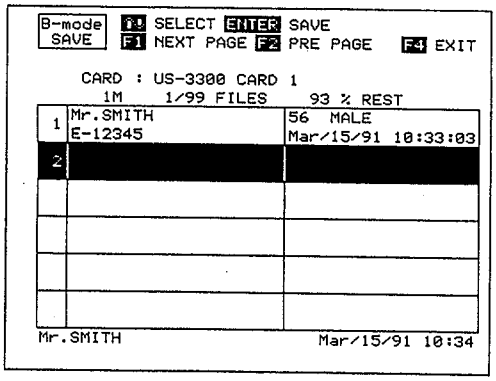


Patient's data

1) Change the mode to the ID-mode and insert the file card. (Refer to "6.11.3 Inserting file card" (p. 6-49).)

2) Select "SAVE B-mode IMAGE [US → CARD]" by the numeric key and press the [ENTER] key.

* The mode is changed over to the save mode of B-mode image.

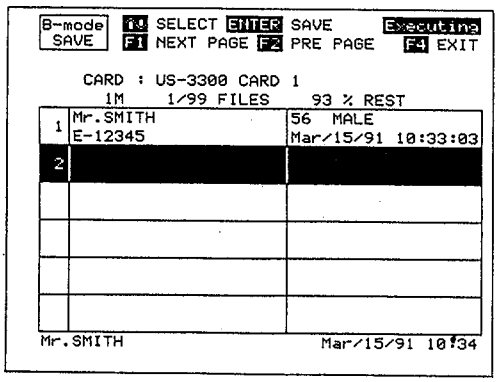


3) Press the [ENTER] key.

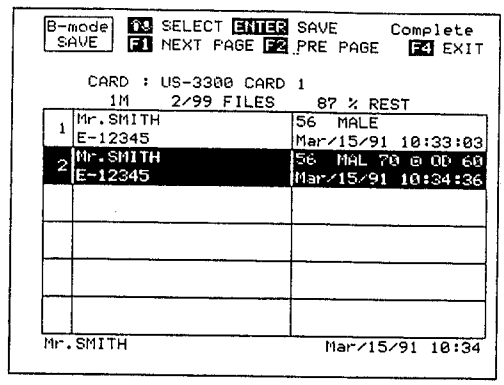
The data can be saved.

Meanwhile, "Executing" is displayed on the right upper of the monitor.

* When changing with the saved data, move the cursor by the arrow key [↓] or [↑] and press the [ENTER] key. Sets, 6 data per set, are displayed in order by pressing the [F1 CLPR] or [F2 AREA] key.



4) After it is complete to save B-mode image, the patient's name, ID No., age, sex, sensitivity, probe orientation, patient's eye (OD/OS), observable range and date and time of the save are displayed on the list of saved data.



NOTE

If the patient's data is not preset the patient's name, ID No., age and sex are not displayed.

We recommend to input the patient's data to distinguish each saved data.

This function is finished with this step.

By pressing the F4 PAGE key, the menu screen of the file card appears.

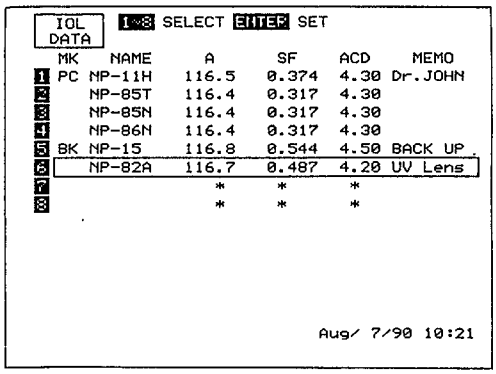
NOTE

The 128K Byte file card can save only one set of B-mode image.

We recommend to use the 1M Byte file card for saving B-mode image.

6.11.7 Save of IOL data

IOL data can be saved into the file card

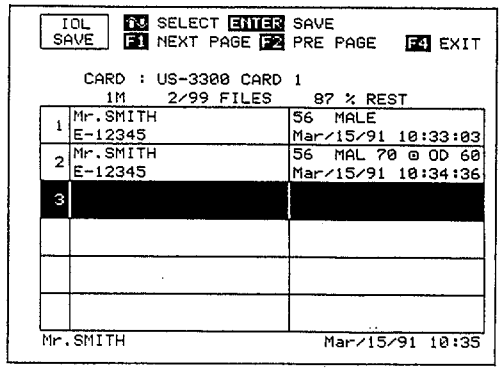


IOL data

1) Change the mode to the ID-mode and insert the file card. (Refer to "6.11.3 Inserting file card" (p. 6-49).)

2) Select "SAVE IOL DATA [US → CARD]" by the numeric key and press the [ENTER] key.

* The mode is changed over to the save mode of IOL data.

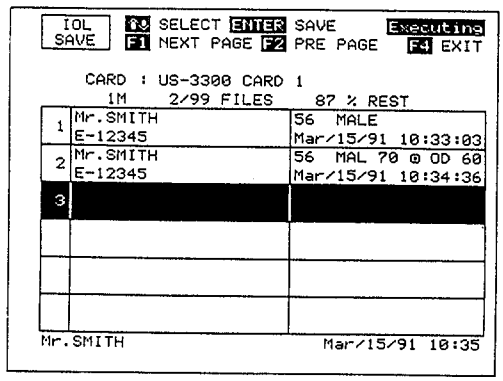


3) Press the [ENTER] key.

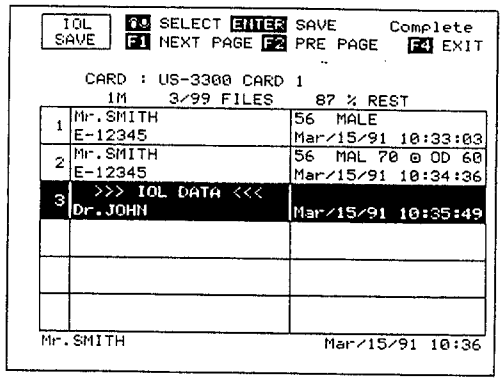
The data can be saved.

Meanwhile, "Executing" is displayed on the right upper of the monitor.

* When changing with the saved data, move the cursor by the arrow key [↓] or [↑] and press the [ENTER] key. Sets, 6 data per set, are displayed in order by pressing the [F1 CLPR] or [F2 AREA] key.



4) After it is complete to save IOL data, ">>>IOL DATA<<<" , date and time of the save, and operator's name are displayed on the list of saved data.



NOTE

If the operator's name is not preset on ID-mode, it is not displayed.

This function is finished with this step.

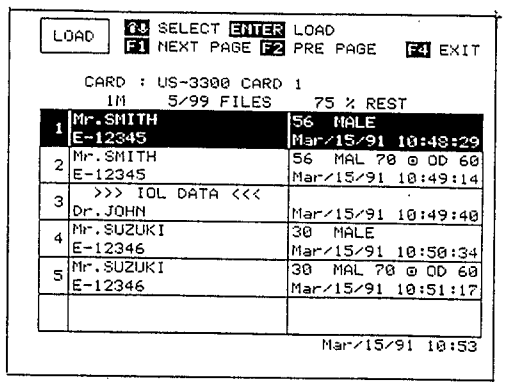
By pressing the F4 PAGE key, the menu screen of the file card appears.

6.11.8 Load of data

The data which is saved into the file card can be loaded. When loading the data, the data memorized into the instrument will be deleted. Load the data after saving the necessary data.

Each of measured data and IOL data or B-mode image and IOL data can be saved and loaded independently. For example, when the measured data is loaded, IOL data memorized into the instrument can not be deleted.

1) Change the mode to the ID-mode and insert the file card. (Refer to "6.11.3 Inserting file card" (p. 6-49).)



2) Select "LOAD [CARD → US]" by the numeric key and press the [ENTER] key.

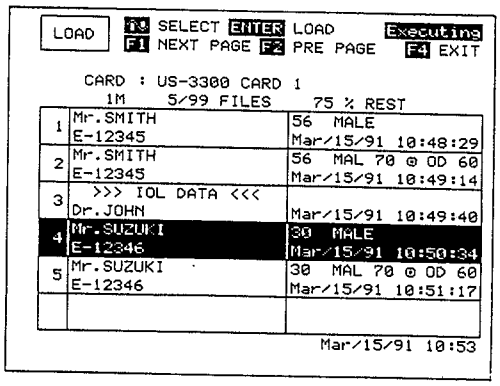
* The mode is changed over to the load mode.

3) Move the cursor to the desired data by the arrow key [↓] or [↑] and press the [ENTER] key.

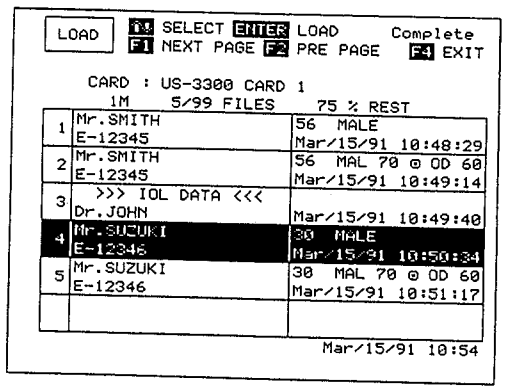
The data can be loaded.

Meanwhile, "Executing" is displayed on the right upper of the monitor.

* Sets, 6 data per set, are displayed in order by pressing the [F1 CLPR] or [F2 AREA] key.



4) After it is complete to load the data, "Executing" is changed to "Complete".



This function is finished with this step.

By pressing the [F4 PAGE] key, the menu screen of the file card appears.

B-mode data (measured data, B-mode image) which is saved in the file card is sampling data.

By loading B-mode data from the file card, changeover of gain curve or display range, caliper function, area function, box function are enable to be used.

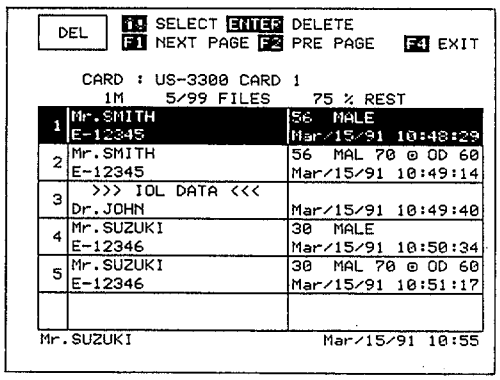
6.11.9 Deletion of data

The data which is saved into the file card can be deleted.

1) Change the mode to the ID-mode and insert the file card. (Refer to "6.11.3 Inserting file card" (p. 6-49).)

2) Select "DELETE" by the numeric key and press the [ENTER] key.

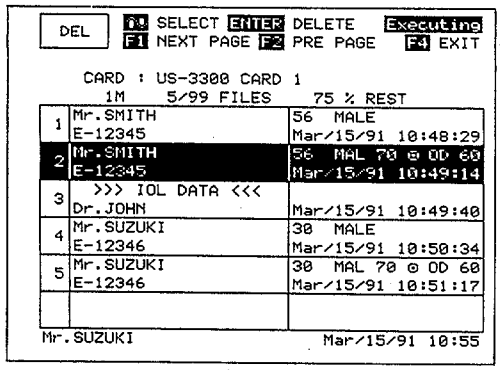
* The mode is changed over to the deletion mode.



3) Move the cursor to the desired data by the arrow key [↓] or [↑] and press the [ENTER] key.

The data can be deleted.

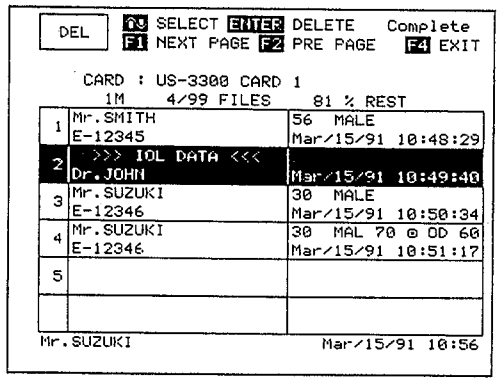
Meanwhile, "Executing" is displayed on the right upper of the monitor.



4) After it is complete to delete the data, "Executing" is changed to "Complete" .

This function is finished with this step.

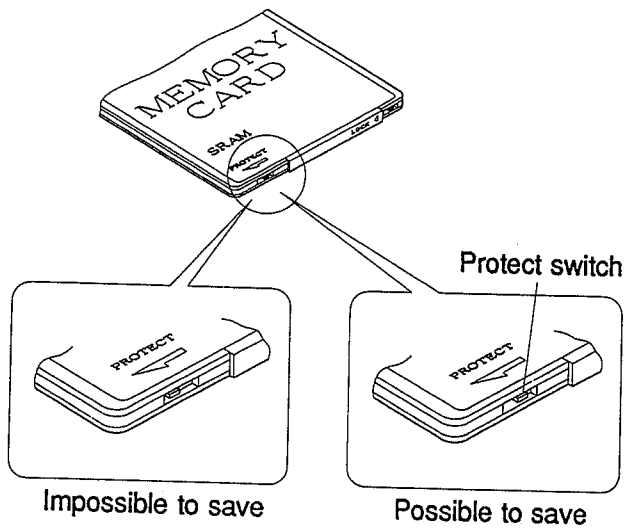
By pressing the [F4 PAGE] key, the menu screen of the file card appears.



6.11.10 Protection of saved data

It is possible to protect the data which is already saved into the file card so as not to delete by mistake.

By sliding the protect switch outside, the file card becomes the state that it is impossible to save any more. By returning the switch to the original state, it is possible to save the data again.



Maintenance

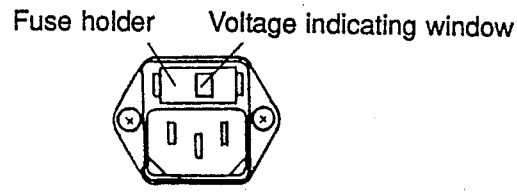
7.1 Replacement of fuse

When the instrument does not work in the power switch ON, the fuse may blow out.
Replace the fuse with a spare one.

<How to replace FUSE-1>

1) Turn the power switch OFF and disconnect the power cord from the outlet and the power receptacle on the rear panel.

2) Push clicks at the both side of the fuse holder and pull out the fuse holder.



CAUTION

As the fuse holder is served as the voltage selector, pay attention not to change the number indicated on the voltage indicating window.

3) Replace with a new fuse and set a fuse holder as before.

NOTES

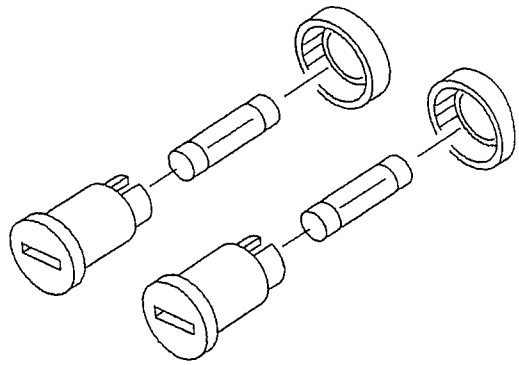
1) If the fuse should blow out again, contact your purchased distributor.
2) Be sure to use the only 1.6A Slow Blow fuse.

<How to replace FUSE-2>

1) Turn the power switch OFF and disconnect the power cord from the outlet.

2) Turn the fuse holder about 90° counterclockwise with pressing the screwdriver, to remove.

3) Replace with a new fuse and turn the fuse holder about 90° clockwise with pressing the screwdriver.



NOTES

1) If the fuse should blow out again, contact your purchased distributor.
2) Be sure to use the only 4A Slow Blow fuses.

7.2 Others

When the appearance of the main unit and keyboard are dirty, wipe them with a soft cloth. If dirt is stubborn, dip the cloth into neutral detergent watered down and wring it dry. And then wipe off with it and wipe a dry soft cloth. Never use organic solvent as thinner in order not to damage their surfaces.

IOL formulas

8.1 Outline of IOL formula

(1) BINKHORST formula

This program is based on the formula of Dr. Binkhorst in order to calculate the refractive power of IOL. This is the most famous formula among the theoretic formulas.

(2) HOLLADAY formula

This program is based on the formula of Dr. Holladay. By reversing the SF value by the stable refractive power after surgery, it is possible for operator to compensate.

(3) SANDERS-RETZLAFF-KRAFF-II formula

This program is based on the formula of Dr. Sanders, Dr. Retzlaff and Dr. Kraff. This formula is the most famous formula among the regression formulas.

8.2 BINKHORST formula

(1) IOL power for ametropia (IOL)

$$IOL = \frac{1000\times N2\times(N2\times K-(N1-1)\times AL'-0.001\times DR\times(VD\times(N2\times K-(N1-1)\times AL')+AL'\times K))}{(AL'-AD)\times(N2\times K-(N1-1)\times AD-0.001\times DR\times(VD\times(N2\times K-(N1-1)\times AD)\times AD\times K))}$$

(2) Post operative refractive error (ERROR)

$$ERROR = \frac{1000\times N2\times(N2\times K-(N1-1)\times AL')-LP\times(AL'-AD)}{N2\times(VD\times(N2\times K-(N1-1)\times AL')+AL'\times K)-0.001}$$

$$\frac{\times(N2\times K-(N1-1)\times AD)}{\times LP\times(AL'-AD)\times(VD\times(N2\times K-(N1-1)\times AD)+AD\times K} + \frac{1}{RD}$$

(3) Post operative aphakic spectacle power (SPECS.)

$$SPECS. = \frac{1000\times N2\times(N2\times K-(N1-1)\times AL')}{N2\times(VD\times(N2\times K-(N1-1)\times AL')+AL'\times K)} + \frac{1}{RD}$$

(4) Post operative aphakic contact lens power (C.L.)

$$C.L. = \frac{1000\times N2\times(N2\times K-(N1-1)\times AL')}{N2\times AL'\times K} + \frac{1}{RD}$$

NOTE

AL'=AL+B-T×(1-N2/N3)

N1 : Corneal refractive index (=4/3 (=1.333...))

N2 : Aqueous and vitreous refractive index (=1.336)

N3 : IOL refractive index (=1.49)

B : Estimated distance from the vitreoretinal interface to the visual cell layer

T : Thickness of implating IOL, initial estimated (=0.5mm)

RD : Refracting distance (=6m)

K : Corneal curvature radius

AD : Post operative anterior chamber depth

AL : Axial length

LP : IOL power to be implanted

DR : Desired refractive power of correction lens after surgery

(+ value : hyperopia, - value : myopia)

VD : Vertex distance (Spectacles : 12mm, Contact lens : 0mm)

8.3 HOLLADAY formula

(1) IOL power for ametropia (IOL)

$$IOL = \frac{1000\times N2\times(N2\times K-(N1-1)\times Alm-0.001\times DR}{(Alm-AD-SF)\times(N2\times R-(N1-1)\times(AD+SF)-0.001\times DR} \times\frac{(VD\times(N2\times K-(N1-1)\times Alm)+Alm\times K))}{\times(VD\times(N2\times K-(N1-1)\times(AD+SF))+(AD+SF)\times K))}$$

(2) Post operative refractive error (ERROR)

$$ERROR = \frac{1000\times N2\times(N2\times K-(N1-1)\times Alm)-LP\times(Alm-AD-SF)}{N2\times(VD\times(N2\times K-(N1-1)\times Alm)+Alm\times K)-0.001} \times\frac{\times(N2\times K-(N1-1)\times(AD+SF))}{\times LP\times(Alm-AD-SF)\times(VD\times(N2\times K-(N1-1)\times(AD+SF))+(AD+SF)\times K)}$$

(3) Surgeon factor (SF)

$$SF = \frac{-BQ-\sqrt{BQ\times BQ-4\times AQ\times CQ}}{2\times AQ} - AD$$

NOTE

Alm = AL+RT

AQ = (N1 - 1) - (0.001×ER×((VD×(N1 - 1)) - K))

BQ = ER×0.001×((Alm×VD×(N1 - 1)) - (K×(Alm - (VD×N2)))) - (((N1 - 1)×Alm)+(N2×K))

CQ = (Alm×N2×K) - (0.001×ER×Alm×VD×K×N2) - (1000×N2×((N2×K) - ((N1 - 1)×Alm) - (0.001×ER×((VD×((N2×K) - ((N1 - 1)×Alm)))+(Alm×K)))))/LP

AD= $0.56+Rag-\sqrt{Rag×Rag-AG×AG/4}$

N1 : Corneal refractive index (=4/3 (=1.333...))

N2 : Aqueous and vitreous refractive index (=1.336)

T : Thickness of implanting IOL, initial estimated (=0.5mm)

RD : Refractive distance (=6m)

RT : Retinal thickness factor (=0.200m)

K : Corneal curvature radius

AD : Post operative anterior chamber depth

AL : Axial length

LP : IOL power to be implanted

DR : Desired refractive power of correction lens after surgery

(+ value : hyperopia, - value : myopia)

VD : Vertex distance (Spectacles : 12mm)

SF : Surgeon factor

ER : Refractive power after surgery

Rag : In the case of K $\geqq$ 7mm Rag=K

In the case of K $<$ 7mm Rag=7mm

* Holladay formula reverse the compensate value (SF value : surgeon factor) by the actual refractive power after surgery and reflect the result on the calculation of IOL refractive power. It is possible to compensate the IOL data obtained by the operator's way and obtain the IOL formula which is fit for the operator. When using a new IOL style, obtain the SF value with the following formula, register as the IOL data and use for calculating IOL refractive power. (Refer to "6.8.1 Registration of IOL data" (p. 6-36).)

SF=(A×0.5663)-65.60

SF : SF value (surgeon factor)

A : A-constant

ex.) In the case of A-constant=116.7

SF=(116.7×0.5663)-65.60=0.48721

When SF value is stable after surgery, register the value as the IOL data again and use for calculating IOL refractive power. (Refer to "6.8.2 SF value reverse operating function" (p.6-38).)

8.4 SANDERS-RETZLAFF-KRAFF-II formula

(1) IOL power for ametropia (IOL)

IOL = A' - 2.5×AL - 0.9×K - DR×CR

(2) Post operative refractive error (ERROR)

ERROR = (A' - 2.5×AL - 0.9×K - LP)/CR

(3) Post operative aphakic spectacle power (SPECS.)

SPECS. = 80.4 - 1.65×AL - 0.7×K

NOTE

K : Corneal curvature radius

AL : Axial length

A : A-constant

LP : IOL power to be implanted

DR : Desired refractive power of correction lens after surgery

(+ value : hyperopia, - value : myopia)

A' : Compensated value of A-constant

	AL < 20.0mm	A'=A+3
20.0mm ≦	AL < 21.0mm	A'=A+2
21.0mm ≦	AL < 22.0mm	A'=A+1
22.0mm ≦	AL < 24.5mm	A'=A
24.5mm ≦	AL	A'=A-0.5

CR : Constant for calculation

P ≦ 14.0 CR=1.00

P > 14.0 CR=1.25

* P=A'-2.5×AL-0.9×K

*1 As to SRK formula, the results of AL within 22 to 24.5mm are the most reliable. As to SRK-II formula, when AL is not within the range, A-constant is compensated. And, the constants for calculation of IOL and ERROR are different, when the emmetropia power (P) is under and over 14D. In this condition, SRK-II formula is the nonlinear formula. And so, when calculating IOL and ERROR by the values approaching the conditioned value, the difference of 0.5 - 1D is made.

ex.) K=45D, DR=-2D, A=116.5

		SRK	SRK-II
In the case of AL=21.99mm	IOL=	24.31D ,	24.53D
In the case of AL=22.00mm	−) IOL=	24.29D ,	23.50D
	Difference	0.02D ,	1.03D

As stated above, the calculated results of SRK-II formula depend on AXIAL and P values.
When calculating by the values approaching the conditioned values, take notice of this.

*2 The measured value is displayed in 4-digit, but 6-digit is available in calculating program. For example, 22.0mm has the range from 21.9950 to 22.0049mm. This 6-digit is used for the calculation of IOL refractive power. And so, the calculated results are different even though the displayed values are equal.

*3 As to this instrument, a little difference is made in the calculated values.

Specifications

B-mode	Probe	Type :	Permanent oil filled & compact probe
		Frequency :	10MHz
		Scanning way :	Mechanical sector scanner
		Sector angle :	60°
		Scanning speed :	Approx. 10Hz
	Display	Observable range :	40 or 60mm from the probe tip Range of ±30° (sector)
		Electrical resolution : (1550m/s)	Observable range 40mm Axial direction 0.09mm Lateral direction Max. 0.2mm Observable range 60mm Axial direction 0.14mm Lateral direction Max. 0.3mm
		Gain curves :	Logarithmic, Linear, S-curve
	Measurement function	Distance :	2 distances can be measured by 2 system calipers
		Area :	Area which is plotted can be measured
	Amplifier	GAIN :	Changeable 0 - 90 dB
		TGC :	Changeable 0 - - 20 dB/cm
A-mode	Probe (option)	Type :	Solid probe
		Frequency :	10MHz
		Internal fixation light :	Red LED
	Display	Measurable value :	Axial length, Anterior chamber depth, Lens thickness, Vitreous length
		Measurable range :	14 - 39mm (Axial length)
		Display unit :	0.01mm
	Amplifier	GAIN :	Changeable 0 - 100%
	Clinical accuracy :		± 0.1mm
	Converted ultrasonic velocity :		1532m/s (Anterior chamber and Vitreous) 1641m/s (Lens)

IOL formula function	Built-in IOL formula :	BIKHORST, HOLLADAY, SANDERS-RETZLAFF-KRAFF-II
	Accuracy :	± 0.01D
Power supply	Voltage :	AC 100, 120, 220, 240V ± 10%
	Frequency :	50/60Hz
	Capacity :	150VA
Dimensions	Main unit :	380(W)×448(D)×212(H)mm
	Keyboard :	370(W)×185(D)×38(H)mm
Weight	Main unit :	17kg
	Keyboard :	1kg

* Specifications and appearance are subject to change without notice for improvement.

Acoustic field emissions

A. The following data are the highest known acoustic field emissions for pre-enactment ophthalmic diagnostic ultrasonic devices :

	Water	In Situ
1. Spatial Peak-Temporal Average Intensity (mW/cm^2)	68	17
2. Spatial Peak-Pulse Average Intensity (W/cm^2)	110	28
3. Maximum Intensity (W/cm^2)	200	50

B. The following data are the measurements of NIDEK US-3300 acoustic field emissions :

	Water	In Situ
1. A-mode probe (A- and BIO-modes)		
● Spatial Peak-Temporal Average Intensity (mW/cm^2)	1.05	0.124
● Spatial Peak-Pulse Average Intensity (W/cm^2)	14.41	1.70
● Maximum Intensity (W/cm^2)	12.66	1.49

	Water	In Situ
2. B-mode probe (B- and CV-modes)		
● Spatial Peak-Temporal Average Intensity (mW/cm^2)	0.095	0.030
● Spatial Peak-Pulse Average Intensity (W/cm^2)	2.45	0.772
● Maximum Intensity (W/cm^2)	3.75	1.18
● Spatial Average-Temporal Average Intensity at the surface (mW/cm^2)	n/a	0.036

NOTE

System control parameters affecting acoustic field emissions are fixed as far as the end user is concerned.

Configuration

11.1 Standard configuration

- B-mode Probe
- Power Cord
- Foot Switch
- Dust Cover
- Spare Fuses (1.6A 1pce., 4A 2pcs.)
- Operator's Manual

11.2 Options

- A-mode Probe (Solid probe for axial length measurement)
- Video Printer
- A-mode Probe Stand with Display Unit
- A-mode Probe Stand
- Probe Adaptor for NIDEK or Haag-Streit Slit Lamp
- Probe Adaptor for Neitz Slit Lamp
- Probe Adaptor for Zeiss Slit Lamp*
- Instrument Stand
- File card (128KByte)
- File card (1MByte)

* Probe Adaptor for Zeiss Slit Lamp is used in addition to Probe Adaptor for NIDEK or Haag-Streit Slit Lamp.

* Specifications and design are subject to change without notice for improvement.

NIDEK CO.,LTD.

HEAD OFFICE : 34-14, Maehama, Hiroishi-cho, Gamagori, Aichi 443, Japan
Telephone: (0533) 67-6611
Facsimile: (0533) 67-6610
Cable: NIDEK

TOKYO OFFICE (International Div.) : 6th Floor, Takahashi Bldg., No.2, 3-chome, Kanda-jinboucho
Chiyoda-ku, Tokyo 101, Japan
Telephone: (03) 3288-0571
Facsimile: (03) 3288-0570
Cable: NIDEK TYO Telex: 2226647 NIDEK J

NIDEK INCORPORATED : 2460 Embarcadero Way P.O. Box 50488 Palo Alto, California 94303, U.S.A.
Telephone: (415) 493-9044 · 9045
Facsimile: (415) 493-2450

NIDEK SOCIÉTÉ ANONYME : Europarc 59, rue Auguste Perret, 94042 CRETEIL, France
Telephone: (1) 49 80 97 97
Facsimile: (1) 49 80 32 08

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